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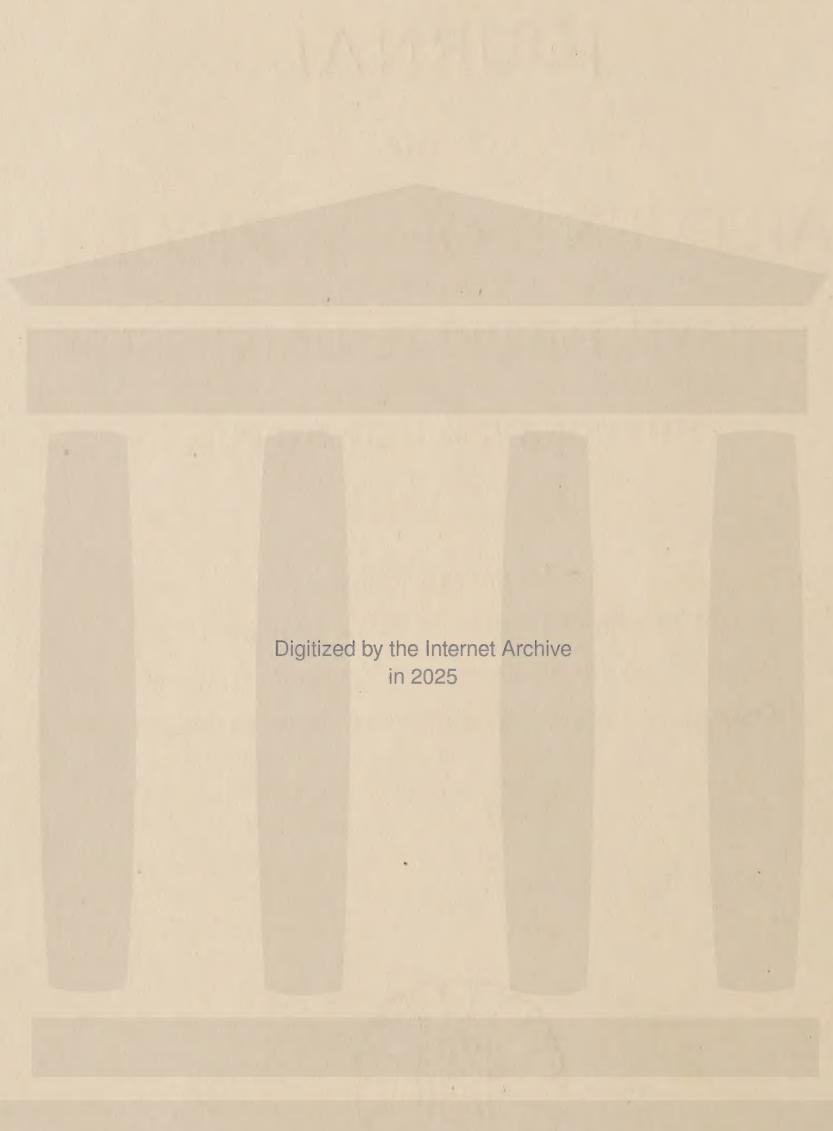
Report on the Ophiurans of Palao, Caroline Islands

Report on the Ophiurans of Yaéyama, Ryukyu

Ophiurans from Some Gulfs and Bays of Nippon



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## REPORT ON THE OPHIURANS OF PALAO, CAROLINE ISLANDS<sup>1)</sup>

Shiro MURAKAMI

### INTRODUCTION

The Palao, or Pelew, group of the South Sea Islands under Nipponese Mandate, lies  $134^{\circ} 10' - 134^{\circ} 43'$  E. Long.,  $6^{\circ} 50' - 8^{\circ} 05'$  N. Lat., or 500 miles north of New Guinea and about 500 miles east of Davao, Philippine Islands. It is composed of two atolls, several larger islands, and numerous limestone islets, arranged from south to north. Each of the islands is surrounded by coral reefs. On both the east and west sides of the group there are lagoons, one on each side, protected by a barrier reef. Further in Palao, between the islands Korōru and Oropusyakaru, there is a bay called Iwayama Bay, which is under no direct influence of the open sea, being called "lagoon in lagoon" or "inner lagoon". The physical, oceanographical and biological conditions of this lagoon differ from those of the others mentioned above. Accordingly great interest is foreseen in a study of the marine fauna of Palao not only faunistically but also ecologically.

The Ophiurans of Palao have already been dealt with by several authors, but our knowledge of them is not to be looked upon as satisfactory, for the species known so far from the region are only sixteen in number. I was fortunate enough to stay at Palao for the purpose of studying Ophiurans there, from Dec. 1937 to June 1938, enjoying the membership of the Palao Tropical

<sup>1)</sup> Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 162; Papers from the Amakusa Marine Biological Laboratory, No. 86.

19. *Ophiotylos leucus* g. et sp. nov.
20. *Ophiurodon cinctum* (BROCK) \*
21. *Ophiurodon cupidum* (KOEHLER) \*
22. *Ophiopezella spinosa* (LJUNGMAN) \*
23. *Ophiarachnella gorgonia* (MÜLLER et TROSCHEL)
24. *Ophiarachnella infernalis* (MÜLLER et TROSCHEL)
25. *Ophiocryptus pacificus* sp. nov.
26. *Ophioclastus hataii* g. et sp. nov.
27. *Ophiocrasis thryptica* sp. nov.
28. *Ophiocoma brevipes* PETERS
29. *Ophiocoma erinaceus* MÜLLER et TROSCHEL
30. *Ophiocoma latilanxa* sp. nov.
31. *Ophiocoma scolopendrina* (LAMARCK)
32. *Ophiomastix annulosa* (LAMARCK)
33. *Ophiomastix asperula* LÜTKEN \*
34. *Ophiomastix bispinosa* CLARK \*
35. *Ophiomastix caryophyllata* LÜTKEN \*
36. *Ophiomastix mixta* LÜTKEN
37. *Ophiomastix palaoensis* sp. nov.
38. *Ophiomastix variabilis* KOEHLER \*
39. *Ophiarthrum elegans* PETERS
- 39'. *Ophiarthrum elegans* var. *unicolor* CLARK \*
40. *Ophiarthrum pictum* MÜLLER et TROSCHEL.

*Ophiothrix elegans*, *Ophiothrix trilineata*, *Ophiarachna incrassata* and *Ophiocoma brevipes* var. *variegata*, which were already reported from Palao, could not be collected by myself. Thus, all the known forms are referable to forty-three species and two varieties. Among them, *Ophiurodon cupidum*, *Ophiopezella spinosa*, *Ophiocoma latilanxa*, *Ophiomastix asperula*, *Ophiomastix caryophyllata* and *Ophiarthrum elegans* var. *unicolor* had [not then] been known to occur from Nipponese territory, but later they were found by me at Isigaki-sima and will be dealt with in the paper following this article. The forms known from Palao may be divided into four groups as follows, from the distributional standpoint:

I. Cosmopolitan species, which are widely distributed in both the Indo-Pacific and Atlantic, but not in the Arctic and Antarctic. The species to be referred to this group, and their known northern limits in the North Pacific are as follows:

*Ophiactis savignyi*

*Amphipholis squamata*

2 species.

Misaki

Philippine Islands.

II. Indo-Pacific species, which range from the Indian Ocean to the Pacific Ocean. The species to be referred to here, and their known northern limits are as follows:

*Ophiothrix trilineata*

Isigaki-sima<sup>1)</sup>

*Macrophiothrix longipedata*

Kominato

*Ophiolepis annulosa*

Okinawa

*Ophiolepis cincta*

Isigaki-sima

*Ophioplacus imbricatus*

Okinawa

*Ophiarachna incrassata*

Okinawa and Ogasawara

(Bonin) Islands

*Ophiarachnella gorgonia*

Misaki districts

*Ophiarachnella infernalis*

Eno-ura

*Ophiocoma brevipes*

South Izu

*Ophiocoma brevipes* var.

variegata

Hawaii

*Ophiocoma erinaceus*

Yaéyama

*Ophiocoma scolopendrina*

Kagoshima Bay

*Ophiomastix annulosa*

Senkaku (Pinnacle) Islands

*Ophiarthrum elegans*

Okinawa.

13 species and 1 variety.

III. Pacific species, which occur in the Pacific Ocean, including the Malaysian waters. The species belonging here, and their known northern limits are as follows:

*Ophiactis hemiteles*

Palao

*Ophiactis macrolepidota*

Uraga Channel

*Ophiactis modesta*

Misaki districts

*Ophiothrix armata*

Banda

*Ophiothrix elegans*

China Sea

*Ophiothela danæ*

Misaki districts

*Ophiurodon cinctum*

Sulu Archipelago

*Ophiurodon cupidum*

Isigaki-sima

*Ophioperezella spinosa*

Isigaki-sima

*Ophiocoma latilinxa*

Isigaki-sima

<sup>1)</sup> See the other paper following this article: Report on the Ophiurans of Yaéyama, Ryukyu. Vol. 7, no. 5.

<i>Ophiomastix asperula</i>	Isigaki-sima
<i>Ophiomastix bispinosa</i>	Palao
<i>Ophiomastix caryophyllata</i>	Isigaki-sima
<i>Ophiomastix mixta</i>	Misaki districts
<i>Ophiomastix variabilis</i>	East Indies
<i>Ophiarthrum elegans</i> var. <i>unicolor</i>	Isigaki-sima
<i>Ophiarthrum pictum</i>	Isigaki-sima.

16 species and 1 variety.

IV. Palao species, which are only known from the islands of Palao and its vicinity. The following species belong here:

<i>Amphioplus iuxthus</i>
<i>Amphioplus platyacanthus</i>
<i>Amphiura crossota</i>
<i>Amphiura leptolepis</i>
<i>Amphiura macroscytalia</i>
<i>Ophiothrix scotiosa</i>
<i>Ophiolepis cardioplax</i>
<i>Ophiotylos leucus</i>
<i>Ophiocryptus pacificus</i>
<i>Ophioclastus hataii</i>
<i>Ophiocrasis thryptica</i>
<i>Ophiomastix palaoensis</i> .

12 species.

While in Palao I made collecting excursions for Ophiurans at many localities, namely Garukoru, Garakakurao, Gatomeru, Ogiwaru, Korōru-reef, Arumizu Passage, Iwayama Bay, Palao Harbour, Gadaraku-reef, Auguruperyū-reef, Kayangusu Island, Periryū (Peleliu) Island and west outer lagoon. These localities are in different ecological conditions, and thus, it is very interesting to treat them under separate headings.

#### I. Intertidal zone.

1. The zone which is generally protected from direct influences of the open sea, and its bed is covered with dead coral fragments, living corals and seaweeds, under which the coral sand is concealed. Geruherugairu and Regio Passage of Iwayama Bay, and Korōru-reef near the Korōru Harbour belong to this zone. The Ophiurans found mainly in these areas are as follows:

*Amphioplus iuxthus*  
*Amphioplus platyacanthus*  
*Amphipholis squamata*  
*Amphiura crossota*  
*Amphiura leptolepis*  
*Ophiothrix scotiosa*  
*Ophiolepis cardioplax*  
*Ophiotylos leucus*  
*Ophiurodon cinctum*  
*Ophiurodon cupidum*  
*Ophiarachnella infernalis*  
*Ophioclastus hataii*  
*Ophiocrasis thryptica*  
*Ophiomastix asperula*  
*Ophiomastix caryophyllata*  
*Ophiomastix bispinosa*  
*Ophiomastix variabilis.*

2. The areas generally facing the open sea or outer lagoon, and the flats being covered with solid rock or coral sand. Garakakūrao, Garukoru, Ogiwāru, Auguruperyū-reef, Gadaraku-reef and Periryū belong to this zone. The Ophiurans occurring in these areas are as follows :

*Macrophiothrix longipedata*  
*Ophiolepis annulosa*  
*Ophioplocus imbricatus*  
*Ophiopezella spinosa*  
*Ophiarachnella gorgonia*  
*Ophiocoma brevipes*  
*Ophiocoma scolopendrina*  
*Ophiomastix annulosa*  
*Ophiomastix mixta.*

II. Under the low water mark.

3. The zone where the water is several metres deep, and the bed is not exposed at low-tide. The greater part of Palao Harbour and the slope of the passage of Iwayama Bay belong to this zone. Eleven species are found in these areas, among which nine occur also at one or all of the foregoing zones. Therefore, only two are restricted to this zone.

<i>Ophiocoma latilanxa</i>	Palao Harbour
<i>Ophiactis modesta</i>	Iwayama Bay.

4. The west outer lagoon represents another zone. There the water is about 20 to 50 metres deep. The following are the members occurring in this zone.

- Ophiactis hemiteles*
- Ophiactis macrolepidota*
- Amphiura macroscytalia*
- Ophiothela danae*.

*Ophiactis savignyi* is found in each area, usually hiding itself in the sponge.

Further, I visited Tokobei Island for investigation of the Ophiuran fauna, and was able to collect seven species, which will also be reported in the present paper. Among them, *Ophiocoma pica* is recorded for the first time from the Nipponese territory. Recently I could find this species at Isigaki-sima also.<sup>1)</sup> The other species, *Ophiarachna incrassata*, is not to be found among my collection of Palao, though it has already been reported from there. The Ophiurans of the above named island are as follows.

1. *Ophiarachna incrassata* (LAMARCK)
2. *Ophiocoma erinaceus* MÜLLER et TROSCHEL
3. *Ophiocoma pica* MÜLLER et TROSCHEL
4. *Ophiocoma scolopendrina* (LAMARCK)
5. *Ophiomastix annulosa* (LAMARCK)
6. *Ophiarthrum elegans* PETERS
7. *Ophiarthrum pictum* (MÜLLER et TROSCHEL).

The materials are all preserved at the Amakusa Marine Biological Laboratory of Kyūsyū Imperial University.

## SYSTEMATICS

### Family Amphiuridae.

#### Subfamily Ophiactinae

##### 1. *Ophiactis hemiteles* CLARK

CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 262, pl. X, figs. 7-8. —1921, Dept. Mar. Biol. Carnegie Inst., X, p. 108, pl. XVI, fig. 1.

<sup>1)</sup> See the other paper which follows this article: Report on the Ophiurans of Yaéyama, Ryukyu. Vol. 7, no. 5.

Locality.—One specimen; off Gasupan, west lagoon, 50 metres, Feb. 21, 1938.

Distribution.—Torres Strait.

The specimen at hand is 2.5 mm across the disk, with arms measuring 23 mm in length. It is somewhat different from the type; the number of arm spines, five or six, is smaller than, and the squamation of the disk is coarser than, in the type. But these differences seem to be of no specific value, probably due to difference in age, for the type is said to be 5 mm across the disk.

## 2. *Ophiactis macrolepidota* MARKTANNER

MARKTANNER-TURNERETSCHER, 1887, Ann. k. k. nat. Hofmus., II, p. 298, pl. XII, figs. 12-13. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 155, fig. 37. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsū Imp. Univ., VII, 1, p. 8.

Locality.—Fourteen specimens; off Gasupan, west lagoon, 50 metres, Feb. 21, 1938.

Distribution.—Uraga Channel; South Izu; New South Wales; Amboina.

## 3. *Ophiactis modesta* BROCK

BROCK, 1888, Zeit. f. wiss. Zool., XLVII, 3, p. 482. DÖDERLEIN, 1896, SEMON-Zool. For- schungsr., V, p. 285, pl. XIV, fig. 1, pl. XV, figs. 5-5b. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 156, fig. 38.

Localities.—Forty-nine specimens; Kaki Passage, Iwayama Bay, 3-4 metres, May 25, 1938. Forty-five specimens; B-division, Iwayama Bay, littoral, May 27, 1938.<sup>1)</sup>

Distribution.—Misaki; Amboina; Torres Strait.

## 4. *Ophiactis savignyi* (MÜLLER et TROSCHEL)

*Ophiolepis savignyi*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 95.

*Ophiactis sexradia*: LYMAN, 1874, Bull. Mus. Comp. Zool., III, 10, p. 253.

*Ophiactis savignyi*: CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 265. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 158, fig. 39. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsū Imp. Univ., VII, 1, p. 8.

Localities.—Eight specimens; D-division, Iwayama Bay, littoral, Dec. 18, 1937. One specimen; K-division, Iwayama Bay, littoral, Dec. 19, 1937. Two specimens; same locality, littoral, Dec. 19, 1937. Thirty-one specimens; C-division, Iwayama Bay, littoral, Dec. 21, 1937. Four specimens; off Gasupan, west lagoon, 50 metres, Feb.

<sup>1)</sup> These divisions of Iwayama Bay are according to ABE, EGUCHI and HIRO.

21, 1938. Twenty-five specimens; Gatomeru, littoral, March 13, 1938. Five specimens; G-division, Iwayama Bay, littoral, March 22, 1938. Eight specimens; J-division, Iwayama Bay, littoral, March 24, 1938. One specimen; south coast of Garugoru Island, Palao Harbour, littoral, March 25, 1938. Nineteen specimens; Geruherugairu, Iwayama Bay, littoral, March 26, 1938. Four specimens; Korōru-reef near Korōru Harbour, littoral, March 29, 1938. Twenty-eight specimens; B-division, Iwayama Bay, littoral, April 3, 1938. One specimen; O-division, Iwayama Bay, littoral, April 20, 1938. One specimen; Gadaraku-reef, littoral, April 21, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Eight specimens; same locality, littoral, May 7, 1938. Six specimens; Kaki Passage, Iwayama Bay, littoral, May 20, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 30, 1938. One specimen; same locality, littoral, June 6, 1938. One specimen; north coast of Urukutāpuru, Palao Harbour, 2-3 metres, June 12, 1938.

Distribution.—Misaki; Izu; Malaysian waters; Australia; Sandwich Islands; Gulf of California; West Indies.

#### Subfamily Amphiurinae

##### 5. *Amphioplus iuxthus* sp. nov.<sup>1)</sup>

(Text-fig. 1)

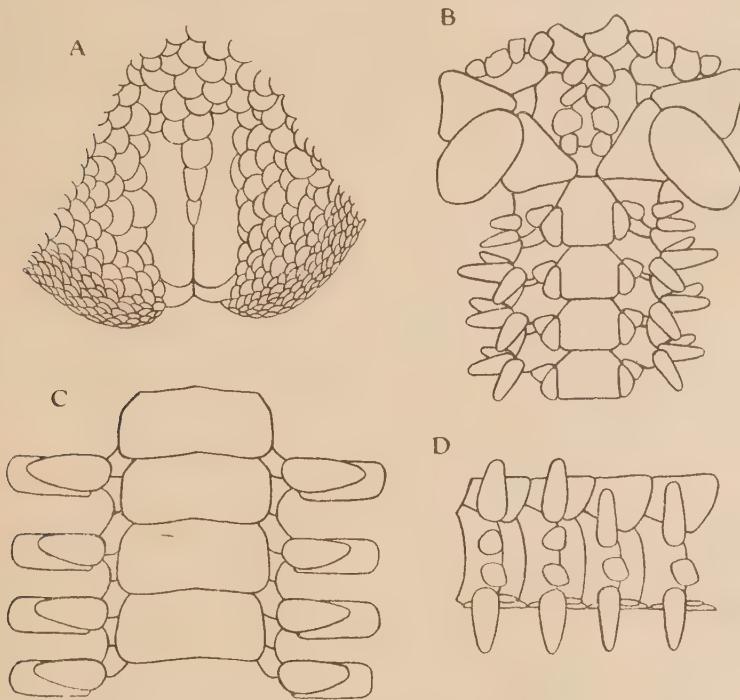
The specimens at hand are in good state of preservation, but their disk was shed after capture. Disk about 7 mm in diametre; arms about 80 mm long.

Disk five-lobed, concave at the interradial border, covered with numerous fine, imbricating scales. Primary plates indistinct. Radial shields small, about two-fifths of the disk radius in length; slender, much longer than broad, tapering within, broadening distally; each pair diverging proximad intervened by several scales. Interbrachial spaces below also covered with scaling similar to, but smaller than, that of the disk above.

Oral shields moderate, lens-shaped, about two times as long as wide. Madreporite large, pentagonal, much longer than broad. Adoral shields rather large, somewhat triangular, meeting within, producing an outer lobe, which separate the first side arm plate

<sup>1)</sup> *Iuxta*, signifying *near to*, in reference to the similarity of the species to *A. parviclypeus*.

from the oral shield. Oral plates higher than broad. Oral papillae four on a side of an oral angle; the distal one small; following



Text-fig. 1. *Amphioplus iuxthus*

A. From above. B. From below. C. Dorsal view of four arm joints near disk. D. Side view of four arm joints near disk.  $\times 21$ .

two large, tetragonal, thin; one at the apex of jaw very thick, but blunt at the tip. Teeth four in number on a jaw, tetragonal; the dorsal one longer than broad, but the undermost one broader than long and very thick.

Arms broader than high and broadest at some distance from the disk. Dorsal arm plates well developed, tetragonal, with rounded disto-lateral angles, about three times as broad as long, distal border somewhat concave, broadly in contact with each other. Those near the disk are not so broad as those at the middle of arm. First ventral arm plate very small, quadrangular, about as broad as long. Second one hexagonal, longer than broad. Following ones pentagonal or tetragonal, with rounded angles, in contact

with each other; at first longer than broad, but becoming broader than long distally. Side arm plates small, not meeting both above and below. Arm spines three to five on each side arm plate, subequal, somewhat longer than an arm segment, flat and blunt at the tip; the second from below rough on the surface and quadrangular in shape. Tentacle scales two to each pore, set at right angles to each other, very large; the adradial larger than the abradial.

Colour (dried from alcohol) gray.

Locality.—Three specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938.

The present species is very closely related to *A. parviclypeus* CLARK, but is easily distinguished from it by the disk shape being concave at the interradial border, and by the larger, but not completely separated, radial shields.

#### 6. *Amphioplus platyacanthus* sp. nov.<sup>1)</sup>

(Text-fig. 2)

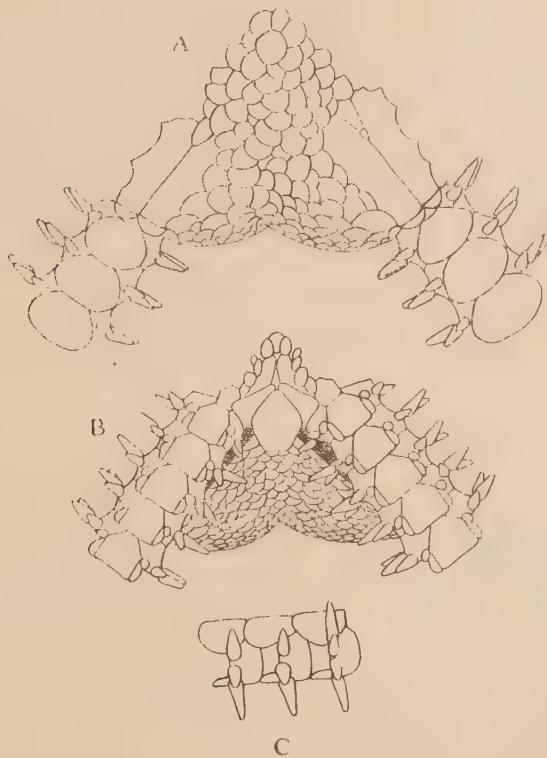
Disk small, not exceeding 3 mm in diameter; arms very long, 16 to 19 mm long. Disk pentagonal, somewhat excavated at the interradial border, covered with numerous coarse, rounded scales, which are more or less overlapping. Primary plates indistinguishable. Radial shields elongate, slightly less than one half of disk radius in length, about three times as long as wide, pointed within, rounded distally, in contact with each other along the distal two-thirds of their length, separated inwardly by a small triangular scale. Interbrachial spaces below covered with many imbricating scales.

Oral shields moderate, arrow-head shaped or pentagonal, longer than broad. Adoral shields somewhat triangular, about two times as long as broad, fully in contact within, separating the first side arm plate from the oral shield distally. Oral papillae four on a side of an oral angle; one at the apex of jaw thick and rounded; following two flat, with a rounded margin; distal one rudimentary, scale-like. Genital slits moderate.

Dorsal arm plates well developed, much broader than long, more or less triangular, each border gently curved and joined

<sup>1)</sup> Πλατύς, signifying *flat*, and ἄκανθα, signifying *spine*, in reference to the flat middle arm spine.

together by a wide rounded angle; they are in contact with each other till near the tip of arm. First ventral arm plate small, pentagonal, longer than wide. Following plates also pentagonal, longer than broad, with a wide proximal angle and a slightly convex distal margin, in contact with each other except those at the distal part of arm. Side arm plates small, not meeting both above and below. Arm spines three, but rarely four near the disk, small, subequal, about as long as a joint; the upper and under ones pointing, while the middle one flat, rough and blunt



Text-fig. 2. *Amphioplus platyacanthus*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 21$ .

at the tip. Tentacle scales two to each pore, set at right angles to each other; the adradial one larger than the abradial one.

Colour (dried from alcohol) white or yellowish gray.

Localities.—Four specimens; Geruherugairu, Iwayama Bay, littoral, March 21, 1938. Nine specimens; same locality, littoral, May 7, 1938. Ten specimens; same locality, littoral, June 11, 1938.

The present species is very near to *A. lœvis* (LYMAN), but is distinguished from it by the coarse scaling of disk, by the longer under arm plates, by the scale-like distal oral papillæ, by the slender arms and by the flat middle arm spines.

### 7. *Amphipholis squamata* (DELLE CHIAJE)

*Asterias squamata*: DELLE CHIAJE, 1828, Mem. anim. Vert. Napoli, 3, p. 74.<sup>1)</sup>

*Amphipholis squamata*: CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 242.

MORTENSEN, 1927, Handbook Ech. British I., p. 221, fig. 125.

Localities.—One specimen; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Eight specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938, and Geruherugairu, Iwayama Bay, littoral, June 11, 1938. Six specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938.

Distribution.—Indo-Pacific and Atlantic Oceans.

This is a small, viviparous and cosmopolitan Ophiuran, which is replaced by *A. japonica* in the Nipponese waters.

### 8. *Amphiura crossota* sp. nov.<sup>2)</sup>

(Text-fig. 3)

Disk contracted, but probably more than 4 mm in diameter; arms 30 to 35 mm long. Disk pentagonal, slightly concave at the interradial border, naked at centre and in the interradii, but around the radial shields there are about five series of delicate, fine scales. Radial shields much longer than broad, about four times as long as wide, scarcely in contact without, slightly diverging proximally. Interbrachial spaces below naked.

Oral shields moderate, somewhat longer than broad, with proximal and distal angles rounded. Adoral shields rather large, triangular, with margins concave, not meeting within, separating the first side arm plate from the oral shield. Oral papillæ two on each side; one at the apex of jaw rounded; the distal one

<sup>1)</sup> Not accessible to me.

<sup>2)</sup> Κροτωνός, signifying *fringed*, in reference to the fringed radial shields.

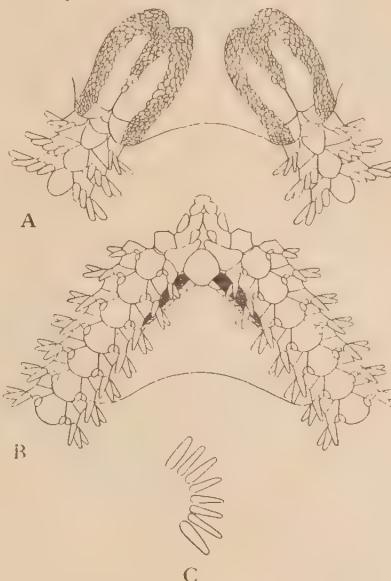
longer than broad, bluntly pointed. A sharply pointed additional one is visible high up on the oral jaw.

One or two basal dorsal arm plates broader than long; following four or five longer than broad, but soon becoming again broader than long distally; proximal border three-sided, distal one rounded; at first scarcely in contact with each other, but soon becoming broadly so distally. First ventral arm plate hexagonal, as broad as long. Following ones tetragonal, broader without than within, with a curved distal border; at first longer than broad, but gradually becoming broader than long without; broadly in contact with each other through the length. Side arm plates very narrow, not meeting both above and below; each carries six, seven or eight subequal, flat, blunt arm spines, among which the undermost one is slightly longer; third and fourth from below are usually pointed posteriorly. Tentacle scales two to each pore, very small.

Colour (dried from alcohol): disk blackish besides the radial shields and their margin which is white; arms whitish; spines tinged with purplish brown.

Locality.—Seven specimens; Geruherugairu, Iwayama Bay, littoral, May 30, 1938.

The present species is very near to *A. diacritica* CLARK, but is easily distinguished from it by the longer radial shields, by the large adoral shields, by a smaller amount of squamation of disk and by the rather thin distal oral papillae.



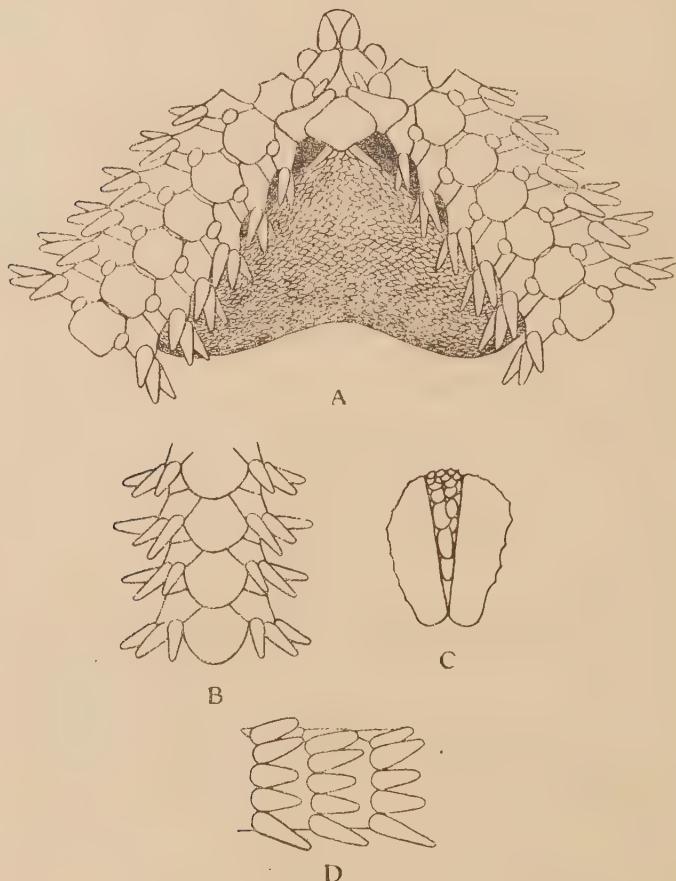
Text-fig. 3. *Amphiura crossota*

A. From above. B. From below. C. Arm spines of one side of an arm joint near disk.  $\times 10.5$ .

9. *Amphiura leptolepis* sp. nov.<sup>1)</sup>

(Text-fig. 4)

The single specimen at hand has its disk broken, but presumably it measured 3 mm in diametre; arms also broken at different distances from the disk, but the longest one measures 24 mm long.

Text-fig. 4. *Amphiura leptolepis*

A. From below. B. Dorsal view of four arm joints near disk.  
 C. Radial shields. D. Side view of three arm joints near disk.  $\times 21$ .

<sup>1)</sup> Λεπτός, signifying *fine*, and λεπίς, signifying *scale*, in reference to the fine disk scales.

Disk five-lobed, concave at the interradial border, covered with many small, imbricating scales. Radial shields rather large, about two-thirds as long as the disk radius, adradial border straight, abradial one very convex, proximal end pointed, distal one rounded, meeting distally, separated within. Interbrachial spaces below also covered with a scaling similar to that of the disk. Genital slits conspicuous. Genital scales indistinct.

Oral shields moderate, in the shape of a diamond with rounded angles, broader than long, but the madreporite as long as broad. Adoral shields long and narrow, broader without than within, not meeting proximally. Oral plates much higher than broad. Oral papillae two on a side; one at the apex of jaw thick and conical, rather pointed within; distal one inserted in the adoral shield, long and narrow, but blunt at the tip. Oral tentacle scales flat, about two times as broad as long, tightly closing the oral slits.

Arms slender. Dorsal arm plates well developed; those on the proximal part of arm somewhat elliptical, slightly broader than long, but those on the middle part of arm being much broader than long, biconvex, with lateral angles rounded; further distally they become as long as broad, having a proximal margin three-sided and a distal margin very convex or semicircular. They are all in contact with each other. First ventral arm plate small, hexagonal, longer than broad. Following ones tetragonal or pentagonal; at first they are somewhat longer than broad, but soon becoming as long as broad distally. Side arm plates slender, not meeting both above and below; each carries four or five short, stout, blunt arm spines, among which the undermost one is largest, and somewhat longer than a joint; two spines situated in the middle rather flat. Tentacle scale one to each pore, moderate, rounded.

Colour (dried from alcohol) light gray.

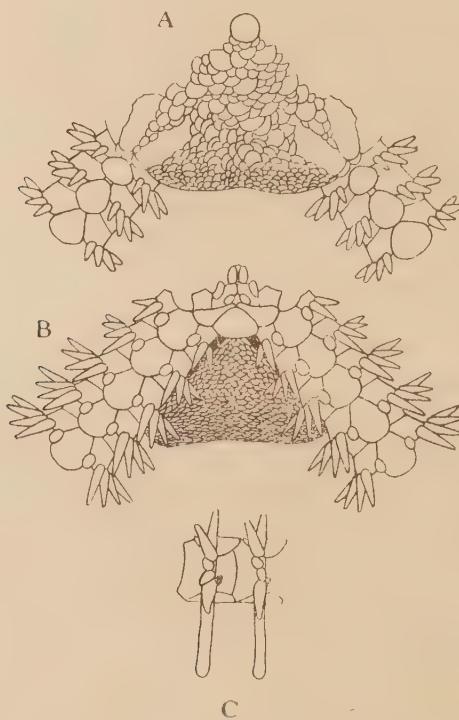
Locality.—One specimen; Korōru-reef, littoral, date unknown.

The present species is very similar to *A. ficta* KÖHLER and *A. velox* KÖHLER, but is easily distinguished from them by the diamond-shaped oral shields, by the broader radial shields, by the conical inner oral papillae and by the number of arm spines.

10. *Amphiura macroscytalia* sp. nov.<sup>1)</sup>

(Text-fig. 5)

Disk about 3 mm in diameter; arms broken, but the longest about 8 mm long. Disk pentagonal or rounded, covered with numerous small, imbricating scales, of which the primary and five interradial plates are distinguishable. Radial shields rather small, less than half the disk radius in length, separated from each other by intervening scales or sometimes meeting distally, about three

Text-fig. 5. *Amphiura macroscytalia*

A. From above. B. From below. C. Side view of two arm joints near disk.  $\times 21$ .

times as long as broad. Interbrachial spaces below covered with a smooth coat of small, imbricating scales.

<sup>1)</sup> *Μακρός*, signifying *long*, and *σκύταλις*, signifying *stick*, in reference to the long undermost arm spine.

Oral shields moderate, rhomboidal or triangular, as long as broad or a little broader than long, with angles rounded. Adoral shields triangular, tapering proximally, not meeting within, but sometimes in contact without. Oral papillae two on a side; proximal one somewhat thick and conical; distal one small, flat, with a rounded margin. Oral tentacle scales flat and broad, in contact with each other so as to close the mouth slits. Genital slits inconspicuous.

Dorsal arm plates somewhat rhomboidal, with distal and lateral angles rounded, a little wider than long except basal one or two plates, in contact with each other till near the tip of arm. First ventral arm plate small, pentagonal, about as wide as long. Following plates tetragonal or pentagonal, longer than broad, with rounded disto-lateral angles; each plate has a special transparent mark on the proximal part. Side arm plates narrow, not meeting both above and below. Arm spines five or six, but there are only three near the tip of arm; from ninth to sixteenth joint, the undermost is very elongate, about two times as long as a joint, slightly curved, and has a blunt tip; the remaining ones are subequal and about as long as a joint. Tentacle scale one to each pore, oval.

Colour (dried from alcohol) whitish.

Locality.—Three specimens; off Gasupan, west lagoon, 20 metres, Feb. 21, 1938.

The present species is closely related to *A. spinipes* MORTENSEN, but differs from it in the larger radial shields and in the rounded distal oral papillae. Further *A. macroscytalia* is allied to *A. magellanica* LJUNGMAN, but is distinguished from it by the rhomboidal or triangular oral shields, by the larger radial shields, by the rhomboidal dorsal arm plates, and by not being viviparous.

### Family Ophiotrichidae

#### 11. *Ophiothrix armata* KÖHLER

KÖHLER, 1905, Siboga-Exp., Oph. Litt., p. 103, pl. X, figs. 1-2. —1922, U. S. Nat. Mus., Bull. 100, V, p. 208, pl. LVII, figs. 3-6, pl. XCIV, fig. 2.

Localities.—Eleven specimens; A-division, Iwayama Bay, littoral, Dec. 17, 1937. Twenty-five specimens; D-division, Iwayama Bay, littoral, Dec. 18, 1937. Ten specimens; K-division, Iwayama Bay, littoral, Dec. 19, 1937. Three specimens: C-division, Iwayama Bay,

littoral, Dec. 21, 1937. Two specimens; O-division, Iwayama Bay, littoral, Dec. 22, 1937. Fifty-three specimens; E-division, Iwayama Bay, littoral, Jan. 18, 1938. Thirty-five specimens; H-division, Iwayama Bay, littoral, March 2, 1938. Nineteen specimens; B-division, Iwayama Bay, littoral, March 19, 1938. Forty-two specimens; G-division, Iwayama Bay, littoral, March 22, 1938. Twenty-six specimens; north coast of Urukutāpuru, Palao Harbour, 2-3 metres, March 23, 1938. Seventy-nine specimens; south coast of Garangoru, Palao Harbour, littoral, March 25, 1938. Fifteen specimens; Geruherugairu, Iwayama Bay, littoral, March 26, 1938. Twelve specimens; Korōru-reef, littoral, March 29, 1938. One specimen; A-division, Iwayama Bay, littoral, March 30, 1938. Twelve specimens; D-division, Iwayama Bay, littoral, April 1, 1938. Three specimens; B-division, Iwayama Bay, littoral, April 3, 1938. Fifteen specimens; Gadaraku-reef, littoral, April 21, 1938. Ten specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Two specimens; Palao Harbour, 2-3 metres, May 15, 1938. Eighteen specimens; Kaki Passage, Iwayama Bay, littoral, May 20, 1938. Four specimens; Geruherugairu, Iwayama Bay, littoral, May 27, 1938. Three specimens; same locality, littoral, May 30, 1938. One specimen; Regio Passage, Iwayama Bay, littoral, June 2, 1938.

Distribution.—East Indies.

## 12. *Ophiothrix scotiosa* sp. nov.<sup>1)</sup>

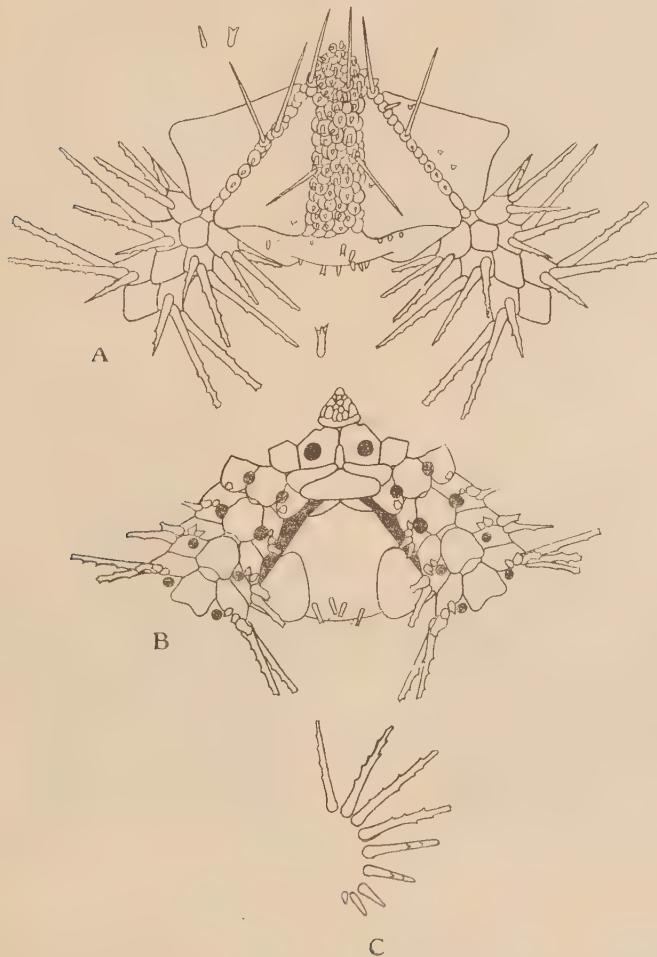
(Text-fig. 6)

Disk 4.5 mm in diameter; arms 25 to 30 mm long. Disk pentagonal or decagonal, covered with coarse elongate scales, each of which almost without exception bears a stump, terminating in two or three diverging, subequal spinelets; some of the scales have a true long spine. Radial shields large, about two-thirds as long as the disk radius, triangular, two times as long as broad, very close together, but perfectly separated from each other by a series of scales, bearing scattered stumps, as in the disk. Interbrachial spaces below naked, but having a number of cylindrical spines. Genital slits small; genital scales large, wide.

Oral shields rhombic, twice as wide as long, with lateral angles rounded. Adoral shields rather small, roughly triangular, not meeting within, lying more or less horizontally. Oral plates large.

1) *σκότιος*, signifying *dark*, in reference to the dark coloration.

stout. Dental papillae about twelve or thirteen in number, arranged in three series; lower papillae smaller.



Text-fig. 6. *Ophiothrix scotiosa*

A. From above. B. From below. C. Arm spines of one side of an arm joint near disk.  $\times 11$ .

Dorsal arm plates rhombic or pentagonal, longer than broad, in contact with each other throughout the length. First ventral arm plate small, hexagonal, broader than long. Following plates tetragonal, with rounded proximal and concave distal borders; first three broadly in contact with each other, but distally becoming

hardly touching, or separated by a narrow strip of naked skin, though the side arm plates are not meeting between the former. Side arm plates narrow, not meeting both above and below. Arm spines six or seven in number, falling to four distally; the upper ones longer, not always the uppermost one being the longest, about twice or more than twice as long as a joint, strongly thorny; the lowest one is hook-shaped, bearing four conspicuous spinelets. Tentacle pores large. Tentacle scale one to each pore, rudimentary, sometimes even absent.

Colour (dried from alcohol) black above; on the dorsal side of arm white bands or flecks are present; lighter below.

Locality.—Eighteen specimens; A-division, Iwayama Bay, littoral, Dec. 17, 1937.

The present species is so close to *O. armata* KÖHLER that one may place it within a range of variation of the latter. But for the present we may be justified to keep it separate from *O. armata* by its black coloration.

### 13. *Macrophiothrix longipeda* (LAMARCK)

*Ophiura longipeda* : LAMARCK, 1816, Anim. sans Vert., II, p. 544.

*Ophiothrix longipeda* : MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 113. MATSUMOTO, 1917,

Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 227, fig. 65.

*Macrophiothrix longipeda* : CLARK, 1938, Mem. Mus. Comp. Zoöl., LV, pp. 282, 288.

Localities.—Nine specimens; Periryū, littoral, April 28, 1938. Five specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Kominato; Queensland; South Africa; Persian Gulf; Society Islands.

### 14. *Ophiothela danæ* VERRILL

VERRILL, 1869, Proc. Boston Soc. Nat. Hist., XII, p. 391.<sup>1)</sup> DÖDERLEIN, 1896, SEMON-Zool.

Forschungsr., V, p. 297, p. XVII, figs. 25-25b. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 230, fig. 67, pl. IV, fig. 8. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp., Univ., VII, 1, p. 20.

Locality.—Three specimens; off Gasupan, west lagoon, 20 metres, Feb. 21, 1938.

Distribution.—Off Misaki; South Izu; Philippine Islands; East Indies; off Syōnan-tō (Singapore); Fiji Islands.

<sup>1)</sup> Not accessible to me.

## Family Ophiolepididae

## Subfamily Ophiolepidinae

15. *Ophiolepis annulosa* MÜLLER et TROSCHEL

*Ophiura annulosa* : BLAINVILLE, 1843, Manu. Act., p. 244, pl. XXIV, figs. 1-4.<sup>1)</sup>

*Ophiolepis annulosa* : MÜLLER et TROSCHEL, 1840, Arch. Naturg., VI, p. 328. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 300, fig. 82.

Locality.—One specimen; Periryū, littoral, April 28, 1938.

Distribution.—Ryukyu Islands; West Australia; Zanzibar; Marshall Islands.

16. *Ophiolepis cardioplax* sp. nov.<sup>2)</sup>

(Text-fig. 7)

Disk 7 mm in diameter; arms 33 to 42 mm long. Breadth of arm 1.5 mm at base.



Text-fig. 7. *Ophiolepis cardioplax*

A. From below. B. From above.  $\times 6.7$ .

Disk pentagonal, with almost straight interradial borders, flat, covered with one hundred and forty-one large, thick, flat plates which are somewhat concave at the centre, and surrounded by small scales. The arrangement of the plates is quite regular and radially symmetrical. Dorsocentral somewhat large, circular. At

<sup>1)</sup> Not accessible to me.

<sup>2)</sup> Καρδία, signifying *heart*, and πλάξ, signifying *plate*, in reference to the heart-shaped oral shields.

the interradial area, they arrange themselves in three series, among which those of the middle one are somewhat larger than the others. Radial shields comparatively small, triangular, flat, sunken, longer than broad, with slightly convex margins and rounded angles, separated from each other by three plates, among which the abcentral one forms with those bordered outside of radial shields a band separating the arm from the disk. Interbrachial spaces below also covered with regularly arranged plates like those of the dorsal side of disk, not surrounded by small ones, which are only present between larger plates. Genital slits long. Genital scales distinct.

Oral shields moderate, pentagonal or somewhat heart-shaped, as long as broad. Adoral shields rather large, slightly tapering inwards, completely in contact with each other at the interradial line, producing a small outer lobe so as to separate the first side arm plate from the oral shield. Oral papillae five on a side of an oral angle, thick, squarish; the distal one is large and pointed, overlapping the next, which is the broadest; remaining three longer than broad, with an obtuse end. Teeth four or five in number, tetragonal, with a slightly rounded margin; undermost one is smallest.

Arms robust, tapering slowly. Dorsal arm plates thick, tetragonal, broader without than within, wider than long, distal margin very convex, broadly in contact with each other. First ventral arm plate small, much broader than long, with convex distal and concave lateral borders. Following ones tetragonal, broader than long, wider without than within, lateral side reentering, distal one convex, broadly in contact with each other; towards the extremity of arm they become gradually longer than broad, pentagonal, and separated from each other by the side arm plate. Side arm plates well developed, but not so high as the arm joint; each carries four arm spines, which are small, subequal, about one-fourth of the corresponding joint in length; the undermost spine is largest. Two tentacle scales to each pore, thick, subequal, jointed together to form an elliptical appearance.

Colour (dried from alcohol): disk brown, arms dirty gray, banded with white; ventral side whitish.

Localities.—Forty-four specimens; Geruherugairu, Iwayama Bay, littoral, May 29, and June 6, 1938. Two specimens; same locality,

littoral, May 2, 1938.

The present species is closely related to *O. irregularis* KÖHLER, but differs from it in the regular squamation of disk, in the broader oral shields, and in having five oral papillae.

### 17. *Ophiolepis cincta* MÜLLER et TROSCHEL

MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 90. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 299, fig. 81.

Localities.—Two specimens; Korōru-reef, littoral, Jan. 28, 1938. One specimen; Kayangusu, Yō Passage, littoral, March 7, 1938. One specimen; Auguruperyū-reef, littoral, May 3, 1938. One specimen; Urukutāpuru, littoral, June 12, 1938.

Distribution.—Yaéyama; New South Wales; Mozambique; Red Sea; Society Islands.

### 18. *Ophioplocus imbricatus* MÜLLER et TROSCHEL

*Ophiolepis imbricata*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 93.

*Ophioplocus imbricatus*: LYMAN, 1865, Ill. Cat. Mus. Comp. Zoöl., I, p. 69. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 344. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 301, fig. 83.

Locality.—One specimen; Periryū, littoral, April 28, 1938.

Distribution.—Ryukyu Islands; West Australia; Murray Islands; Gilbert Islands; Zanzibar; Madagascar; Mauritius; Philippine Islands; Java; Amboina; Torres Strait.

### *Ophiotylos leucus* g. et sp. nov.

#### *Ophiotylos* g. nov.<sup>1)</sup>

Disk swollen, covered with stout plates encircled by a series of small scales. Radial shields somewhat distinct, separated from each other. Trio of plates present just outside and between each pair of radial shields. Oral and adoral shields stout. Teeth indistinct. Oral papillae four or five, thick and close-set. Genital slits inconspicuous. Arms short, rather stout, knobbed, tapering gradually. Dorsal and ventral arm plates small. Side arm plates well developed. Arm spines few, rudimentary. Tentacle scales large, single.

<sup>1)</sup> "Οφις, signifying *snake*, and τύλος, signifying *knob*, in reference to the knobbed arms.

Type species.—*Ophiotylos leucus*.

The new genus is very peculiar in several features. The squamation of disk remains us of that of *Ophiolepis*, but *Ophiotylos* differs from it in want of supplementary dorsal arm plates. It is also similar to *Ophiomusium* in having the well developed side arm plates, but in the latter genus ventral arm plates and tentacle pores are lacking except in the proximal ones.

19. *Ophiotylos leucus* sp. nov.<sup>1)</sup>

(Text-fig. 8)

Disk 3.8 mm in diameter; arms 5 mm long. Breadth of arm 0.9 mm near the disk.

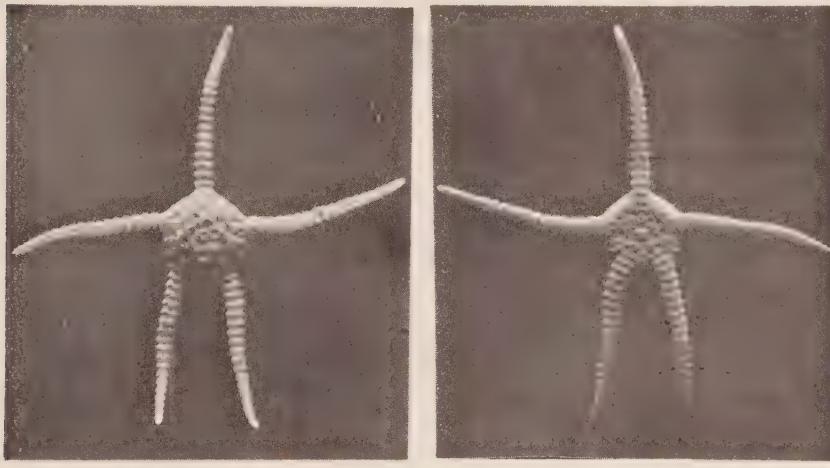
Disk pentagonal, with slightly convex or straight interradial borders, swollen on the dorsal side and flat on the ventral side, covered with forty-six large, subequal plates, which are surrounded by small scales. Dorsocentral, first and second radials rounded; interradials arranged in one series, tetragonal, thick, but concave at the centre. Radial shields small, but larger than the other plates, triangular, much broader than long, completely separated from each other. Those adjoining abaxial to the radial shields make a band with the distal scale of those lying along the radial line. Interbrachial spaces below covered with three large plates surrounded by small scales which are coarser than the corresponding ones of the dorsal side of disk. Genital slits long, more than two arm joints in length, bounded by elongate genital scales.

Oral shields, of moderate size, about as long as broad or a little broader than long, distal border semicircular, proximal borders slightly concave, and make a rather sharp inner angle. Adoral shields comparatively large, broader without, slightly tapering within, broadly in contact with each other on the interradial line, producing a small outer lobe so as to separate the first side arm plate from the oral shield. Oral plates small, triangular, higher than broad. Oral papillae four or five on each side of an oral angle, truncated; the penultimate largest. Teeth two, thick, somewhat triangular, with a blunt tip.

Arms stout, slowly tapering, broader than high. First dorsal arm plate tetragonal, broader than long, broader without than

<sup>1)</sup> Λευκός, signifying *white*, in reference to the white coloration.

within, with a convex distal border and sharply pointed distolateral angles. Next one fan-shaped, as long as broad, with a very narrow proximal border, scarcely in contact with the first one.



Text-fig. 8. *Ophiotylos leucus*  
A. From above. B. From below.  $\times 3.4$ .

Beyond it they become triangular and smaller in size; near the end of arm they are broadly separated from each other by the side arm plate. At the basal half of arm the dorsal arm plates have a conspicuous boss near the middle of distal border. First ventral arm plate somewhat triangular, with a broad median lobe on the distal border, much broader than long. Following ones pentagonal, longer than broad, broader without than within, distal border slightly convex, lateral border concave, proximal and distolateral angles acute. At first they are in contact with each other, but soon becoming separated from each other distally. Side arm plates large, well developed, thick at the distal border, fully in contact both above and below except a few basal joints. Two arm spines on each side arm plate, rudimentary. Tentacle scale one on each pore, large, oval.

Colour in life white.

Locality.—Fifty-four specimens; Geruherugairu, Iwayama Bay, littoral, March 21, 22 and June 6, 11, 1938.

## Family Ophiidermatidae

## Subfamily Ophiarachninae

20. *Ophiurodon cinctum* (BROCK)

*Ophioconis cincta* : BROCK, 1888, Zeit. f. wiss. Zool., XLVII, 3, p. 480. KŒHLER, 1905, Siboga-Exp., Oph. litt., p. 14, pl. II, fig. 2-3.

*Ophiurodon cinctum* : MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 84. KŒHLER, 1922, U. S. Nat. Mus. Bull. 100, V, p. 351, pl. LXXXI, fig. 5.—1930, Vidensk. Medd. fra Dansk Naturh. Foren., LXXXIX, p. 277.

Localities.—Two specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. One specimen; same locality, littoral, May 18, 1938. Fourteen specimens; same locality, littoral, June 11, 1938.

Distribution.—Amboina; Mindoro; Banda; Sulu Archipelago.

21. *Ophiurodon cupidum* (KŒHLER)

*Ophioconis cupida* : KŒHLER, 1905, Siboga-Exp., Oph. litt., p. 15, pl. I, figs. 19-20.

*Ophiurodon cupidum* : MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 84. KŒHLER, 1930, Vidensk. Medd. fra Dansk Naturh. Foren., LXXXIX, p. 278. CLARK, 1932, Sci. Rep. Gt. Barrier Reef Exp., IV, 7, p. 203.

Locality.—Thirteen specimens; Geruherugairu, Iwayama Bay, littoral, June 6-11, 1938.

Distribution.—Isigaki-sima; Moluccas; Sulu; East Indies; Mindanao; Kei Islands; Queensland.

22. *Ophiarachna incrassata* (LAMARCK)

*Ophiura incrassata* : LAMARCK, 1816, Anim. sans Vert., II, p. 542.

*Ophiarachna incrassata* : MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 104. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 299. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 318, fig. 88, pl. VI, fig. 4.

Locality.—Four specimens; Tokobei, littoral, April 6-16, 1938.

Distribution.—Ryukyu Islands; Ogasawara (Bonin) Islands; Zanzibar; Ceylon; Darros Islands; Amboina; Fiji Islands; Queensland.

## Subfamily Ophiidermatinae

23. *Ophiopezella spinosa* (LJUNGMAN)

*Ophiarachna spinosa* : LJUNGMAN, 1867, Öfv. Kongl. Vet.-Akad. Föhr., XXIII, p. 305.<sup>1)</sup>

*Pectinura spinosa* : LYMAN, 1874, Bull. Mus. Comp. Zoöl., III, 10, p. 221.

<sup>1)</sup> Not accessible to me.

*Ophiopezella spinosa*: LYMAN, 1882, Challenger Oph., p. 17. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 304.

*Ophiopezella lütkeni*: de LORIOL, 1893, Rev. Suisse de Zool., I, p. 392, pl. XIII, figs. 1-1e.

Localities.—One specimen; Periryū, littoral, April 28, 1938. Three specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Isigaki-sima; Philippine Islands; Society Islands; Torres Strait.

#### 24. *Ophiarachnella gorgonia* (MÜLLER et TROSCHEL)

(Text-fig. 9)

*Ophiarachna gorgonia*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 105.

*Pectinura gorgonia*: LÜTKEN, 1869, Add. Hist. Oph., III, p. 33.

*Ophiarachnella gorgonia*: CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 117.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 305. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 323, pl. VI, fig. 7. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 33.

Localities. — Two specimens; Kayangusu, Yō Passage, littoral, March 7, 1938. Five specimens; Periryū, littoral, April 28, 1938. Four specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution. — Misaki; South Izu; Africa; Zanzibar; Palao Islands; Fiji Islands; Samoa; New Guinea; Torres Strait; Queensland; Gilbert Islands.



Text-fig. 9. *Ophiarachnella gorgonia*.

From above.  $\times 1$ .

#### 25. *Ophiarachnella infernalis* (MÜLLER et TROSCHEL)

*Ophiarachna infernalis*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 105.

*Pectinura infernalis*: LÜTKEN, 1869, Add. Hist. Oph., III, p. 33.

*Ophiarachnella infernalis*: CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 124.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 305. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 324, fig. 90.

Localities.—Nine specimens; G-division, Iwayama Bay, littoral, March 22, 1938. One specimen; J-division, Iwayama Bay, littoral, March 24, 1938. Two specimens; G-division, Iwayama Bay, littoral, March 26, 1938. One specimen; B-division, Iwayama Bay, littoral, April 3, 1938. Thirty-seven specimens; A'-division, Iwayama Bay, littoral, May 1, 1938. Twelve specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Fifteen specimens; B-division, Iwayama Bay, littoral, May 5, 1938. Sixteen specimens; Geruherugairu, Iwayama Bay, littoral, May 7, 1938. Thirteen specimens; A'-division, Iwayama Bay, littoral, May 11, 1938. Two specimens; Marakaru, Palao Harbour, littoral, May 17, 1938. One specimen; Kaki Passage, Iwayama Bay, littoral, May 20, 1938. Five specimens; Korōru-reef, littoral, May 26, 1938. Four specimens; Geruherugairu, Iwayama Bay, littoral, May 30, 1938. One specimen; Urukutāpuru, littoral, June 12, 1938.

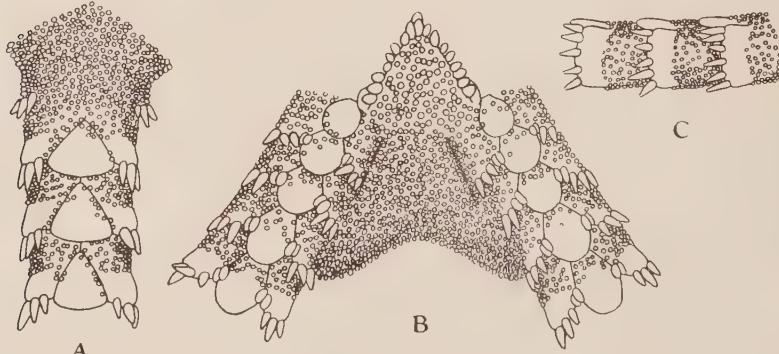
Distribution.—Suruga Gulf; Philippine Islands; Palao Islands; Zanzibar; Torres Strait; New Guinea.

### 26. *Ophiocryptus pacificus* sp. nov.

(Text-fig. 10)

Disk 4 mm in diametre; arms all broken at different distances from the disk, the longest among them being 9 mm in length.

Disk flat, pentagonal, covered with numerous small granules. Radial shields invisible. Interbrachial spaces below, oral shields,



Text-fig. 10. *Ophiocryptus pacificus*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 21$ .

adoral shields and oral plates also covered with granulation similar to that of the disk. Arms also granulated, especially the side arm plates being so, but the granules are limited to the proximal half of each plate and diminishing in number distally. Oral papillae nine, rarely eight or ten, on a side, small, subequal; proximal ones conical; distal ones flat and blunt, except the outermost one which is pointed and overlapping the penultimate.

Dorsal arm plates triangular, a little longer than broad, distal margin slightly convex, proximal angle acute; only proximal two or three scarcely in contact with each other. First ventral arm plate distinct, somewhat circular, longer than broad. Following plates tetragonal or pentagonal, with a very convex distal border; at first they are as wide as long, but soon becoming longer than broad distally. Side arm plates well developed, meeting both above and below except those near the disk; each carries five or six small, subequal, conical arm spines, which are about one-third as long as a joint. Tentacle scales two near the disk, but falling to one at the distal part of arm, small, elongate.

Colour (dried from alcohol): dorsal side of disk dirty gray; arms light gray, annulated with light brownish olive; ventral side light gray.

Localities.—One specimen; north coast of Marakaru, Palao Harbour, littoral, May 19, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 29, 1938.

The new species differs from *O. maculosus* CLARK in the flat pentagonal disk not bulging in each interradius, in the small number of oral papillae and in the longer arms. It is also different from *O. hexacanthus* CLARK by the concealed radial shields. Further, the present species is distinguished from *O. dubius* CLARK by the arms incompletely covered with the granules, by the number of arm spines and by two genital slits in each interradius. KÖHLER and CLARK thought that the Ophiurans belonging to the present genus were nothing but young of *Ophioderma*, but I cannot accept their opinion, for not a single individual of adult *Ophioderma* was found in Palao.

*Ophioclastus hataii* g. et sp. nov.*Ophioclastus* g. nov.<sup>1)</sup>

Disk flat, covered with numerous fine granules. Radial shields invisible. Interbrachial spaces below and oral plates also covered with granulation quite as on the disk, but oral and adoral shields being bare. Oral papillae numerous. Teeth rather slender. Arm plates well developed. One supplementary dorsal arm plate present on each side of the dorsal arm plate. Arm spines numerous, rather small. Tentacle scales two.

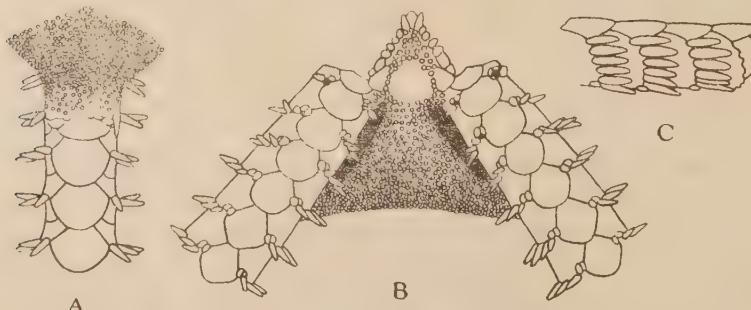
Type species.—*Ophioclastus hataii*.

The present genus is easily distinguished from the other genera of Ophiodermatidae by the possession of supplementary dorsal arm plates.

27. *Ophioclastus hataii* sp. nov.<sup>2)</sup>

(Text-fig. 11)

Disk 6.5 mm in diameter; arms six in number, about 26 mm long, tapering slowly. Disk hexagonal, covered with numerous fine granules, under which small, rounded scales are concealed. Radial shields invisible. Interbrachial spaces below covered with granulation like that of the dorsal surface of disk.

Text-fig. 11. *Ophioclastus hataii*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 8.7$ .

<sup>1)</sup> "Οφις, signifying *snake*, and κλαστός, signifying *broken in pieces*, in reference to having the supplementary dorsal arm plates.

<sup>2)</sup> The species is dedicated to Dr. S. Hatai, the Director of the Palao Tropical Biological Station.

Oral shields naked, triangular, with angles rounded, about as broad as long, surrounded by granules. Adoral shields also naked, small, triangular. Oral plates covered with granules, which are coarser than those of the disk. Oral papillae seven in number on each side; the distal one small, pointed at the tip, overlapping the next, which is the broadest of all; proximal four conical, among which the one at the apex of jaw is large and stout. Teeth three in number on each jaw, slender, elongate, pointed at the tip.

Dorsal arm plates well developed, tetragonal, wider without than within, distal border convex, broadly in contact with each other; at first they are broader than long, but soon becoming longer than broad distally. Supplementary dorsal arm plates conspicuous, one on each side. First ventral arm plate large, much broader than long, with an obtuse proximal angle and a very rounded distal border. Following plates at first broader than long, but immediately becoming longer than broad distally; proximal two or three octagonal or heptagonal, and broadly in contact with each other, but distally they become rhomboidal, and separated from each other. Side arm plates not meeting above and below near the disk; each carries five or six, subequal, blunt arm spines, which are a little less than the corresponding joint in length. Tentacle pores indistinct, protected by two scales, among which the abradial one is larger, rounded, and overlapping the base of undermost arm spine. The first arm tentacle pore is sometimes provided with three scales. Genital slits broad, beginning close to the oral shield and reaching the fourth joint.

Colour (dried from alcohol): disk dirty gray; arms also dirty gray, banded with deep gray; ventral side lighter.

Localities.—Fifteen specimens; Geruherugairu, Iwayama Bay, littoral, May 2, 1938. Thirty-nine specimens; A'-division, Iwayama Bay, littoral, May 11, 1938, Geruherugairu, Iwayama Bay, littoral, June 11, 1938, and Regio Passage, Iwayama Bay, littoral, June 2, 1938. Two specimens; Arakabesan Passage, littoral, June 5, 1938. Thirteen specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938.

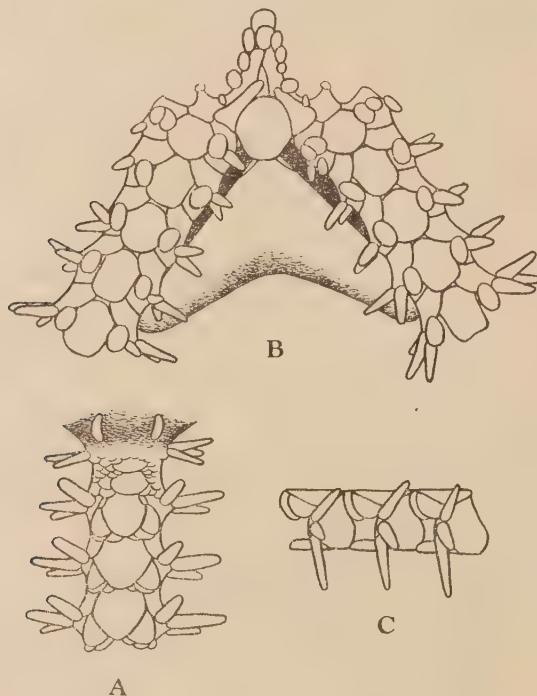
Family Ophiochitonidae<sup>1)</sup>

## Subfamily Ophionereidinae

28. *Ophiocrasis thryptica* sp. nov.<sup>1)</sup>

(Text-fig. 12)

Disk 3 mm in diameter; arms six in number, 20 mm long. Disk hexagonal, covered with many small delicate scales. Radial shields small, triangular or wedge-shaped, tapering within, twice as long as broad, widely separated from each other. Interbrachial spaces below entirely naked, except for marginal area.

Text-fig. 12. *Ophiocrasis thryptica*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 21$ .

Oral shields moderate, somewhat lens-shaped, longer than broad. Adoral shields long and narrow, slightly broader without than within,

<sup>1)</sup> Θρυπτικός, signifying *delicate*, in reference to the delicate disk scales.

usually in contact with each other on the interradial line, but sometimes separated from each other. Oral papillae four on a side of an oral angle, small, flat with a rounded margin. Teeth three in number on a jaw, oblong. One small dental papilla present. Genital slits conspicuous.

Arms slender. Dorsal arm plates longer than broad, proximal margin three-sided, distal margin convex, but distally they become pentagonal, with a sharp proximal angle and a rounded distal margin. They are in contact with each other near the disk, but gradually becoming separated from each other as it proceeds distally. Supplementary plates large; each furnished with two secondary scales just distal to it. First ventral arm plate small, tetragonal, nearly as broad as long. Following plates pentagonal, longer than broad, in contact with each other at first, but becoming less so distally, and finally near the end they are separated from each other. Side arm plates narrow, not meeting above and below, except those of the terminal part of arm; each carries three, subequal, slender arm spines, which are slightly less than a joint in length. Tentacle scale single, large, oval.

Colour (dried from alcohol): disk gray, having a marking of brownish purple at the base of arm. Arms grayish, with brownish purple bands.

Localities.—Three specimens; A'-division, Iwayama Bay, littoral, May 19, 1938. Two specimens; Geruherugairu, Iwayama Bay, littoral, June 6, 1938. Five specimens; same locality, littoral, June 11, 1938.

The present species is closely related to *O. dictydisca* CLARK, but is easily distinguished from it by the lens-shaped oral shields, by the longer dorsal arm plates and by the sharply pointed radial shields.

#### Family Ophiocomidae

##### Subfamily Ophiocominae

###### 29. *Ophiocoma brevipes* PETERS

PETERS, 1852, Arch. Naturg., p. 85.<sup>1)</sup> CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 291. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 343, fig. 85. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 34.

<sup>1)</sup> Not accessible to me.

Localities.—One specimen; Kayangusu, Yō Passage, littoral, March 7, 1938. One specimen; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Hyūga; South Izu; Zanzibar; Mauritius; Philippine Islands; Caroline Islands; Gilbert Islands; Amboina; New Guinea; Torres Strait; Queensland; Lord Howe Island; Fiji Islands; Hawaii.

### 30. *Ophiocoma erinaceus* MÜLLER et TROSCHEL

MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 98. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 257.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 291.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 127.

*Ophiocoma scolopendrina* var. *erinaceus* : MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 345, fig. 96.

Localities.—Seven specimens; Tokobei, littoral, April 6–16, 1938. One specimen; A'-division, Iwayama Bay, littoral, May 1, 1938. Seven specimens; same locality, littoral, May 11, 1938. One specimen; Marakaru, Palao Harbour, littoral, May 17, 1938. One specimen; Korōru-reef, littoral, May 26, 1938.

Distribution.—Yaéyama; Zanzibar; Torres Strait; Lord Howe Island; Society Islands; Hawaiian Islands.

### 31. *Ophiocoma latilanxa* sp. nov.<sup>1)</sup>

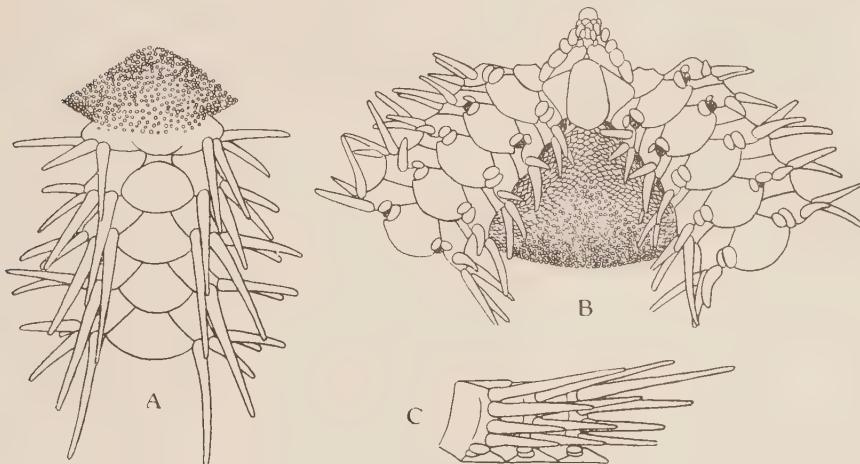
(Text-fig. 13)

Disk 6.5 mm in diameter; arms 20 mm long. Disk pentagonal, covered with fine, dense granules, under which small delicate scales are concealed. Interbrachial spaces below also covered with fine scaling, but the granulation not reaching the oral shield and genital slit. Genital slits moderate; genital scales inconspicuous.

Oral shields moderate, pentagonal, with rounded angles, longer than broad, broader without than within, proximal border rounded. Adoral shields large, triangular, longer than broad, standing on the lateral side of oral shield, not meeting within. Oral plates small. Oral papillae four on a side; distal one large, pointed within; the penultimate broadest, flat, with a somewhat rounded margin; proximal two small, also flat, blunt at the tip. Dental papillae about

<sup>1)</sup> *Latus*, signifying *broad*, and *lanx*, signifying *plate*, in reference to the broad ventral arm plates.

fifteen in number, arranged in three series, small, conical; some of them being borne on the oral plate.



Text-fig. 13. *Ophiocoma latilanza*

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 11$ .

Dorsal arm plates fan-shaped, broader without than within, with a convex distal border; at first they are broader than long and in contact with each other, but becoming longer than broad and separated from each other as it goes distally. First ventral arm plate small, slightly broader than long, broader without than within. Succeeding plates tetragonal or pentagonal, with a very convex distal margin; they are broader than long and in contact with each other near the disk, but becoming longer than broad and separated from each other near the tip of arm. Side arm plates slender, not meeting above and below at the proximal part of arm. Arm spines four, but rarely five, in number proximally, falling to three near the tip of arm, very slender; the uppermost one or two very long, more than twice the corresponding arm joint in length; the length of spines diminishing downwards, but even the undermost one is still much longer than an arm segment. Tentacle scales two to each pore, rather large; abradial one larger than the adradial.

Colour (dried from alcohol): disk light gray in the background, variegated with brown; arms annulated with brown; ventral side lighter.

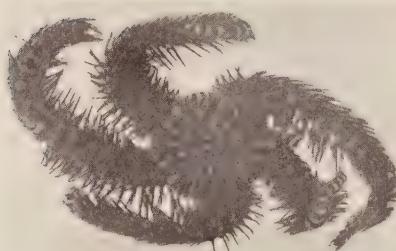
Locality.—Two specimens; north coast of Urukutāpuru, Palao Harbour, 2-3 metres, March 23, 1938.

The present species is very near to *O. lubrica* KÖHLER, but is easily distinguished from it by the broad pentagonal ventral arm plate, by the more numerous dental papillae and by the pentagonal oral shields.

### 32. *Ophiocoma pica* MÜLLER et TROSCHEL

(Text-fig. 14)

*Ophiocoma pica*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 101. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 293.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 127, pl. XIII, fig. 8.



Text-fig. 14. *Ophiocoma pica*  
From above.  $\times 1$ .

*Ophiocoma lineolata*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 102. KÖHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 324, pl. LXXIII, figs. 1-4.

Locality. — Three specimens; Tokobei, littoral, April 6-16, 1938.

Distribution.—Isigaki-sima; Zanzibar; Red Sea; Torres Strait; Paumotus; Gilbert Islands; Society Islands; Hawaiian Islands.

### 33. *Ophiocoma scolopendrina* (LAMARCK)

*Ophiura scolopendrina*: LAMARCK, 1816, Anim. sans Vert., II, p. 544.

*Ophiocoma scolopendrina*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 101. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 293.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 125, pl. XIII, fig. 9.

*Ophiocoma scolopendrina* typical: MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII. 2, p. 345, pl. VII, figs. 4-5.

Localities.—Twelve specimens; Periryū, littoral, Jan. 22, 1938. Eight specimens; Ogiwaru, littoral, Feb. 5, 1938. Thirteen specimens; Kayangusu, Yō Passage, littoral, March 7, 1938. Eight specimens; Garakakurao, littoral, March 14, 1938. Six specimens; Tokobei, littoral, April 6-16, 1938. One specimen; Periryū, littoral, April 28, 1938. Seven specimens; Auguruperyū-reef, littoral, May 3, 1938.

Distribution.—Kagoshima Gulf; Cape of Good Hope; Arabian Gulf; Australia; Paumotus; Hawaiian Islands.

### 34. *Ophiomastix annulosa* (LAMARCK)

*Ophiura annulosa*: LAMARCK, 1816, Anim. sans Vert., II, p. 543.

*Ophiomastix annulosa*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 107. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 289, pl. XVI, fig. 11. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 350, fig. 99, pl. VII, fig. 6.

Localities.—Three specimens; Tokobei, littoral, April 6–16, 1938. One specimen; Periryū, littoral, April 28, 1938.

Distribution.—Senkaku (Pinnacle) Islands; Philippine Islands; Minikoi; Ceylon; East Indies; Solomon Islands; Loyalty Islands; Torres Strait.

### 35. *Ophiomastix asperula* LÜTKEN

(Text-fig. 15)

LÜTKEN, 1869, Add. Hist. Oph., III, p. 45. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 290, pl. XV, fig. 9. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 134, pl. XIV, fig. 1.

Locality.—Two specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938.

Distribution.—Isigaki-sima; Zanzibar; Amboina; East coast of Borneo; Torres Strait; Fiji Islands.



Text-fig. 15.  
*Ophiomastix asperula*  
From above.  $\times 1$ .

### 36. *Ophiomastix bispinosa* CLARK

CLARK, 1917, Bull. Mus. Comp. Zoöl., LXI, 12, p. 442, pl. II, figs. 1–2.—1932, Gt. Barrier Reef Exp., IV, 7, p. 207.

Locality.—One specimen; A'-division, Iwayama Bay, littoral, May 11, 1938.

Distribution.—Paumotus; Australia.

It was fortunate to encounter with such a rare species. The specimen at hand agrees very well with CLARK's original description and figures. The description runs as follows:

Disk 6.5 mm in diameter; arms broken, but the longest about 40 mm long. Disk five-lobed, deeply excavated at the interradial margin, closely covered with numerous small, thin, imbricating scales, which are perfectly concealed by the skin bearing many spinelets. Radial shields invisible. Interbrachial spaces below also covered with the covering similar to that of the disk. Genital slits moderate.

Oral shields transversely oval, broader than long. Adoral shields small, triangular, not meeting within, slightly enlarged without. Oral plates inconspicuous. Oral papillae three on a side, thick and blunt. Dental papillae about ten in number, stout.

Arms long, very slowly tapering, covered with skin at the base. Dorsal arm plates transversely oval, wider than long, broadly in contact with each other proximally. First ventral arm plate very small, longer than broad. Following plates tetragonal, as broad as long, wider without than within with rounded angles, scarcely in contact at the base of arm. Side arm plates rather small, narrow, not meeting above and below at least near the disk. Arm spines three or four, stout and blunt, a little longer than a joint; some of the uppermost ones enlarged, about twice as long as a joint, forming a club-spine. Tentacle pores small, protected by a single oval scale.

Colour (dried from alcohol): chocolate in general; arms have obscure white bands at irregular intervals. Arm spines annulated by white and chocolate. Disk spines sometimes white.

37. *Ophiomastix caryophyllata* LÜTKEN (Text-fig. 16)



Text-fig. 16.  
*Ophiomastix caryophyllata*  
From above.  $\times 1$ .

LÜTKEN, 1869, Add. Hist. Oph., III, p. 43. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 290, pl. XV, figs. 10-10a. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294.

One specimen; locality unknown.

Distribution.—East coast of Borneo; Amboina; Torres Strait; Saleyer; Sulu Archipelago; New Guinea; Fiji Islands.

### 38. *Ophiomastix mixta* LÜTKEN

LÜTKEN, 1869, Add. Hist. Oph., III, p. 44. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 256, fig. 126.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 296. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 348, fig. 97. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsū Imp. Univ., VII, 1, p. 34.

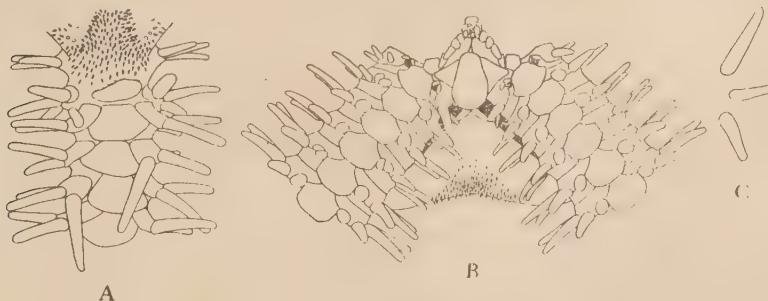
Locality.—Four specimens; Periryū, littoral, April 28, 1938.

Distribution.—Misaki; Izu; Isigaki-sima; Amboina; Timor; Torres Strait; Samoa; Loyalty Islands; Fiji Islands.

### 39. *Ophiomastix palaoensis* sp. nov.

(Text-fig. 17)

Disk 16 mm in diameter; arms (broken in all the specimens at hand, but) more than 65 mm long. Disk pentagonal, slightly excavated at the interradial border, covered with thick skin, which carries numerous fine spines. Those spines are only recognizable under a magnifying lens. Interbrachial spaces below covered with skin which is exactly like that of the disk, but no spines are borne near the genital slits and oral shield.



Text-fig. 17. *Ophiomastix palaoensis*

A. From above. B. From below. C. Arm spines of one side of an arm joint near disk.  $\times 3.5$ .

Oral shields large, much longer than broad, broader without than within, proximal and distal margins rounded, lateral side

slightly concave. Adoral shields moderate, triangular, with rather sharp angles, longer than broad, not meeting on the interradial line. Oral plates inconspicuous. Oral papillae four on a side, thick and robust; the penultimate largest, twice as broad as long; proximal two longer than broad, with a rounded free end. Dental papillae thirteen to fifteen in number, thick and stout, but the undermost ones are rather small and feeble. Genital slits large, but genital scales inconspicuous.

The base of arm covered with extention of disk skin. Dorsal arm plates large, fan-shaped, wider than long, in contact with each other. First ventral arm plate small, pentagonal, about as long as broad. Following plates well developed, wider than long, distal margin convex, proximal border three-sided, lateral side concave, fully in contact with each other till near the tip of arm. Side arm plates narrow, not meeting above and below; each carries three or four arm spines, which are about twice or more than twice as long as a joint, thick, cylindrical, and blunt at the tip; the uppermost spine of every two or three joints is exceedingly large, about three times as long as a joint, or even longer than that, forming a club-spine. Tentacle scales generally single, but sometimes two, large, rounded.

Colour (dried from alcohol): deep chocolate in general; ventral side lighter; distal part of arm annulated with white lines.

Localities.—One specimen; K-division, Iwayama Bay, littoral, Dec. 19, 1937. Three specimens; Arumizu Passage, littoral, Jan. 22, 1938. Five specimens; A'-division, Iwayama Bay, littoral, March 11, 1938. One specimen; south coast of Garangoru, Palao Harbour, littoral, March 25, 1938. One specimen; Geruherugairu, Iwayama Bay, littoral, May 7, 1938. Three specimens; Regio Passage, Iwayama Bay, littoral, May 24, 1938. Four specimens; same locality, littoral, June 2, 1938.

The present species is very near to *O. variabilis* KÖHLER, only differing from it in larger number of disk spines, in the uniform coloration of disk without peripheral white markings, in the arm striation which is limited to the distal part of arm, and in larger size of body.

40. *Ophiomastix variabilis* KOEHLER

KOEHLER, 1905, Siboga-Exp., Oph. litt., II, p. 69, pl. VI, fig. 16, pl. XVI, figs. 3-4. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 138.

Localities.—One specimen; Korōru-reef, littoral, March 29, 1938. Four specimens; A'-division, Iwayama Bay, littoral, May 11, 1938. One specimen; Korōru-reef, littoral, May 26, 1938. One specimen; Regio Passage, Iwayama Bay, littoral, June 2, 1938.

Distribution.—East Indies; Kei Island.

41. *Ophiarthrum elegans* PETERS

PETERS, 1851, Monatsb. K.-Preuss. Akad. Wiss., p. 463. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 296. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 351, fig. 100, pl. VII, fig. 7. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 139, pl. XIII, fig. 1.

Localities.—Two specimens; Kayangusu, Yō Passage, littoral, March 7, 1938. Two specimens; Tokobei, littoral, April 6-16, 1938. Six specimens; Periryū, littoral, April 28, 1938. Two specimens; A'-division, Iwayama Bay, littoral, May 1, 1938. Ten specimens; Auguruperyū-reef, littoral, May 3, 1938. Two specimens; A'-division, Iwayama Bay, littoral, May 11, 1938. Three specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938. One specimen; north coast of Urukutāpuru, Palao Harbour, littoral, June 12, 1938.

Distribution.—Ryukyu; Zamboanga; Philippine Islands; Mozambique; Zanzibar; Palao Islands; Caroline Islands; New Guinea; Torres Strait; Society Islands; Queensland.

41'. *Ophiarthrum elegans* var. *unicolor* CLARK

CLARK, 1932, Gt. Barrier Reef Exp., IV, 7, p. 208.

Localities.—Two specimens; A'-division, Iwayama Bay, littoral, May 1, 1938. One specimen; same locality, littoral, May 11, 1938. Five specimens; same locality, littoral, May 20, 1938. Two specimens; Regio Passage, Iwayama Bay, littoral, June 2, 1938. Two specimens; Arakabesan Passage, littoral, June 5, 1938.

Distribution.—Australia.

The living animals have a number of red speckles on the dorsal side of arm, which are very fugitive in alcohol.

42. *Ophiarthrum pictum* (MÜLLER et TROSCHEL)

*Ophiocoma picta* : MÜLLER et TROSCHEL, 1842, Sys. Ast.. p. 102.

*Ophiarthrum pictum* : LYMAN, 1874, Bull. Mus. Comp. Zoöl., III, 10, p. 225, pl. VII, figs. 2-4. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 297.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 140, pl. XII, fig. 1. OHSHIMA, 1935, Bot. Zool., III, 3, p. 62, fig. 28, b-c.

Localities.—One specimen; Kayangusu, Yō Passage, littoral, March 7, 1938. One specimen; B-division, Iwayama Bay, littoral, May 19, 1938. Five specimens; Tokobei, littoral, April 6-16, 1938. One specimen; Periryū, littoral, April 28, 1938. One specimen; A'-division, Iwayama Bay, littoral, May 1, 1938. Three specimens; same locality, littoral, May 11, 1938. One specimen; north coast of Marakaru, Palao Harbour, littoral, May 17, 1938. One specimen; Regio Passage, Iwayama Bay, littoral, June 7, 1938.

Distribution.—Yaéyama; East Indies; Philippine Islands; Amboina; Timor; New Guinea; Torres Strait.

(Amakusa Marine Biological Laboratory, Kumamoto-ken)

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## REPORT ON THE OPHIURANS OF YAÉYAMA, RYUKYU<sup>1)</sup>

Shiro MURAKAMI

### INTRODUCTION

In 1917, Dr. MATSUMOTO published an elaborate paper on the Japanese Ophiuroidea, in which are reported some Ophiurans from Yaéyama. In 1935, Dr. OHSHIMA wrote an interesting paper on animals of Yaéyama, in which he added further records of Ophiurans from the district. By these two publications, the Ophiuran fauna of Yaéyama has been made clear for the most part. I paid a visit to Isigaki-sima from June to July in 1941, with an intention of studying the Ophiuran fauna of the district more thoroughly. I engaged in a collection of Ophiurans on the reef flat, which projects westwards from the south end of the island, forming an arc. The outer side of the reef faces on the open sea, deepening very rapidly, while the inner side is reverse; here the water is shallow, offering an excellent collecting field. As a result of work on the reef, I was able to get twenty-nine species and one variety, among which two are regarded as new to science and nineteen are recorded from the district for the first time. Though some of them are only known from the Pacific region, mainly Malayan Seas, the greater part of them generally live on shallow bottoms in the Tropical Indo-Pacific region and are widely distributed.

<sup>1)</sup> Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 163; Papers from the Amakusa Marine Biological Laboratory, No. 87.

Further, among these Ophiurans, six have their northern limit at Okinawa, one at Amami-Ōsima, one at Kagoshima, one at south Izu, two at Misaki and one at Kominato. The Ophiurans in the collection and their known northern limits may be listed as follows:

1. <i>Ophiomyxa brevispina</i> <sup>1)</sup>	Isigaki-sima
2. <i>Ophiothrix propinqua</i> *	Isigaki-sima
3. <i>Ophiothrix trilineata</i> *	Isigaki-sima
4. <i>Ophiothrix vicina</i> *	Isigaki-sima
5. <i>Macrophiothrix hirsuta</i>	Senkaku (Pinnacle) Islands
6. <i>Macrophiothrix longipeda</i> *	Kominato
7. <i>Macrophiothrix schmidti</i> *	Okinawa
8. <i>Ophiolepis annulosa</i>	Okinawa
9. <i>Ophiolepis cincta</i>	Isigaki-sima
10. <i>Ophioplacus imbricatus</i>	Okinawa
11. <i>Ophiarachna incrassata</i>	Okinawa; Ogasawara (Bonin) Islands
12. <i>Ophiarachna ohshimai</i> sp. nov.	
13. <i>Ophiurodon cupidum</i> *	Isigaki-sima
14. <i>Ophiopeza spinosa</i> *	Isigaki-sima
15. <i>Ophiarachnella gorgonia</i> *	Misaki
16. <i>Ophiarachnella septemspinosa</i> *	Isigaki-sima
17. <i>Ophionereis aplacophora</i> sp. nov.	
18. <i>Ophiocoma brevipes</i>	South Izu
19. <i>Ophiocoma erinaceus</i>	Kagoshima
20. <i>Ophiocoma latilanxa</i> *	Isigaki-sima
21. <i>Ophiocoma pica</i> *	Isigaki-sima
22. <i>Ophiocoma scolopendrina</i>	Amami-Ōsima
23. <i>Ophiomastix annulosa</i> *	Senkaku (Pinnacle) Islands
24. <i>Ophiomastix asperula</i> *	Isigaki-sima
25. <i>Ophiomastix caryophyllata</i> *	Isigaki-sima
26. <i>Ophiomastix liitkeni</i> *	Okinawa
27. <i>Ophiomastix mixta</i> *	Misaki
28. <i>Ophiarthrum elegans</i> *	Okinawa
28'. <i>Ophiarthrum elegans</i> var. <i>unicolor</i> *	Isigaki-sima
29. <i>Ophiarthrum pictum</i>	Isigaki-sima

<sup>1)</sup> Those marked with an asterisk(\*) are the forms recorded as new to the fauna of Yaéyama.

Before going further, I have to express my gratitude to Professor Dr. H. OHSHIMA for his interest in the work and his guidance given to me throughout the work. To the Japan Society for the Promotion of Scientific Research also I must tender my thanks for giving me the financial aid. Further my thanks are due to Messrs. T. KAWAHARA and T. MASAKI who helped me in many ways during my journey, and to Mr. S. MIYAKE who kindly gave me some worthy specimens he had collected from the same district.

## SYSTEMATICS

### Family Ophiomyxidae

#### 1. *Ophiomyxa brevispina* MARTENS<sup>1)</sup>

MARTENS, 1870, Arch. f. Nat., p. 249. BROCK, 1888, Zeit. f. wiss. Zool., XLVII, 3, p. 530. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 298, pl. XVII, figs. 27-27a.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 28, 1941. Two specimens; same locality, littoral, July 2, 1941. One specimen; same locality, littoral, July 9, 1941.

Distribution.—Amboina.

The specimens at hand are about 15 mm across the disk, with the arms being five times as long as the disk diameter. The disk is pentagonal and is covered with naked skin, but the interradial border is ornamented by a series of oblong scales. The radial shields are moderate in size and broader than long. There are four oral papillae on a side of an oral angle, among which the distal one is rudimentary, while the others are very large and have a transparent, strongly serrated border. The terminal unpaired papilla resembles the latter. The arm spines are four to five in number in some specimens, while in others there are five to six; they are small and less than the segment in length. The colour is deep brownish red and the arms are faintly annulated.

### Family Ophiotrichidae

#### 2. *Ophiothrix propinqua* LYMAN

LYMAN, 1816, Proc. Boston Soc. Nat. Hist., VIII, p. 83.<sup>2)</sup>

<sup>1)</sup> The specimens are preserved at the Amakusa Marine Biological Laboratory of Kyūsyū Imperial University.

<sup>2)</sup> Not accessible to me.

-1865, Ill. Cat. Mus. Comp. Zoöl., I, p. 174. KŒHLER, 1898, Bull. Sci., XXXI, p. 97, pl. III, figs. 20-22. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 277. KŒHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 256, pl. XXXVIII, figs. 1-2, pl. CI, fig. 4.

Locality.—Three specimens; Isigaki-sima, Yaéyama, littoral, June 28, 1941.

Distribution.—Zanzibar; Mauritius; Philippine Islands; off Timor; Torres Strait; Gilbert Islands.

The specimens at hand measure 2.0 to 5.5 mm across the disk. The arms of the largest specimen are all regenerating, while those of the smaller ones are very long. The dorsal side of disk is almost unarmed, but a few scales have granules. The spines of interbrachial areas are very small. The dorsal arm plates are trapezoid and wider than long, having the distal border almost straight. The colour is variegated with purple on a gray background; arms are annulated by a similar coloration. The ventral side is gray.

### 3. *Ophiothrix trilineata* LÜTKEN

LÜTKEN, 1869, Add. Hist. Oph., III, pp. 58, 100. BROCK, 1888, Zeit. f. wiss. Zool., XLVII, 3, p. 508. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 279. KŒHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 279, pl. XLVI, figs. 1-3, pl. CII, fig. 4.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 28, 1941. Five specimens; same locality, littoral, July 9, 1941. One specimen; same locality, littoral, July 10, 1941.

Distribution.—Mozambique; Mauritius; East Indies; Torres Strait; Palao Islands; Samoa.

All the specimens bear three light, well-marked lines, running along the dorsal side of arm, the constant character of this species. This is one of the forms widely distributed in the Indo-Pacific region.

### 4. *Ophiothrix vicina* KŒHLER

KŒHLER, 1930, Vidensk. Medd. fra naturh. Foren., LXXXIX, p. 182, pl. XI, figs. 7-9.

Locality.—Three specimens; Isigaki-sima, Yaéyama, littoral, July 9, 1941.

Distribution.—Banda.

The specimens are different from the type in having denticulated spines of disk and in having the radial shields separated by

only one series of scales along the radial area, not by two or three series of them. But in the other characters they are quite in agreement with the type specimen.

### 5. *Macrophiothrix hirsuta* (MÜLLER et TROSCHEL)

*Ophiothrix hirsuta* : MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 111. MARKTANNER-TURNERET-SCHER, 1887, Ann. k. k. naturh. Hofmus., II, p. 311, pl. XIII, figs. 34-35. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 272. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 225, fig. 63. KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 234, pl. XXXI, figs. 1-2, pl. XXXIII, fig. 13, pl. XCIX, fig. 2.

*Macrophiothrix hirsuta* : CLARK, 1938, Mem. Mus. Comp. Zoöl., LV, pp. 282, 283.

Locality.—One specimen; Isigaki-sima, Yaéyama, littoral, June 28, 1941.

Distribution.—Red Sea; Zanzibar; Philippine Islands; West Australia; Torres Strait; Senkaku (Pinnacle) Islands.

Our specimen is small, being about 8 mm across the disk, but agrees very well with MARKTANNER's specimen, especially in possession of a few granules on the radial shields.

### 6. *Macrophiothrix longipeda* (LAMARCK)

*Ophiura longipeda* : LAMARCK, 1816, Anim. sans Vert., II, p. 544.

*Ophiothrix longipeda* : MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 113. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 274. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 227, fig. 65. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 110, pl. XV, fig. 5, pl. XXXIII, fig. 1. KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 235, pl. XXXI, figs. 3-4, pl. XXXIII, figs. 9-10, pl. C, fig. 2.

*Macrophiothrix longipeda* : CLARK, 1938, Mem. Mus. Comp. Zoöl., LV, pp. 282, 288.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 28, 1941. Three specimens; same locality, littoral, July 2, 1941. Three specimens; same locality, littoral, July 3, 1941. Three specimens; same locality, littoral, July 9, 1941.

Distribution.—Persian Gulf; Zanzibar; Mauritius; Kominato; Philippine Islands; Amboina; Java; New Guinea; Torres Strait; Queensland; Palao Islands; Marshall Islands; Fiji Islands; Society Islands.

### 7. *Macrophiothrix schmidti* (DJAKONOV)

*Ophiothrix schmidti* : DJAKONOV, 1930, Zool. Jahrb., Syst., LIX, 2/3, p. 237, pl. XII, figs. 1-2.

Locality.—Two specimens; Isigaki-sima, Yaéyama, littoral, June 1940 (MIYAKE).

Distribution.—Okinawa.

The specimens at hand are about 8 to 11 mm across the disk, with the arms being ten times as long as the disk diameter. The disk is somewhat pentagonal in shape and is covered with many granules with several short points, which become true spines towards the periphery. The radial shields are large and entirely naked, having a few purplish flecks on the surface. I think that the present species must be transferred to the genus *Macrophiothrix* because of its having the long arms and horizontally directed arm spines.

#### Family Ophiolepididae

##### 8. *Ophiolepis annulosa* MÜLLER et TROSCHEL

*Ophiura annulosa*: BLAINVILLE, 1843, Manu. Act., p. 244, pl. XXIV, figs. 1-4.<sup>1)</sup>

*Ophiolepis annulosa*: MÜLLER et TROSCHEL, 1840, Arch. Naturg., VI, p. 328. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 300, fig. 82. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 181.

*Ophiolepis superba*: CLARK, 1915, Spolia Zeylanica, X, p. 89.-1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 343. OHSHIMA, 1935, Bot. Zool., III, 3, p. 64, fig. 28, f-h.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 25, 1941. One specimen; same locality, littoral, July 2, 1941. One specimen; same locality, littoral, July 10, 1941.

Distribution.—Zanzibar; Philippine Islands; Ryukyu; West Australia; New Guinea; Torres Strait; Solomon Islands; Caroline Islands; Marshall Islands.

##### 9. *Ophiolepis cincta* MÜLLER et TROSCHEL

MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 90. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 342. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 299, fig. 81. OHSHIMA, 1935, Bot. Zool., III, 3, p. 63. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 183.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 25, 1941. Two specimens; same locality, littoral, July 2, 1941. Four specimens; same locality, littoral, July 9, 1941. One specimen; same locality, littoral, July 10, 1941.

<sup>1)</sup> Not accessible to me.

Distribution.—Zanzibar; Mozambique; Red Sea; Yaéyama; Philippine Islands; Amboina; Torres Strait; New South Wales; Caroline Islands; Society Islands.

#### 10. *Ophioplocus imbricatus* (MÜLLER et TROSCHEL)

*Ophiolepis imbricata* : MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 93.

*Ophioplocus imbricatus* : LYMAN, 1865, Ill. Cat. Mus. Comp. Zoöl., I, p. 69. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 344. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 301, fig. 83. OHSHIMA, 1935, Bot. Zool., III, 3, p. 64, fig. 28, d-e. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 183.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 1940 (MIYAKE). Five specimens; same locality, littoral, June 25, 1941. One specimen; same locality, littoral, July 10, 1941.

Distribution.—Zanzibar; Madagascar; Mauritius; West Australia; Okinawa; Philippine Islands; Java; Amboina; Halmahera; Torres Strait; Palao Islands; Gilbert Islands.

### Family Ophiidermatidae

#### 11. *Ophiarachna incrassata* LAMARCK

*Ophiura incrassata* : LAMARCK, 1816, Anim. sans Vert., II, p. 542.

*Ophiarachna incrassata* : MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 104. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 299. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 318, fig. 88, pl. VI, fig. 4. KEHLER, 1922, U.S. Nat. Mus., Bull. 100, V, pl. IV, figs. 6-7. OHSHIMA, 1935, Bot. Zool., III, 3, p. 63. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 186.

Localities.—Four specimens; Isigaki-sima, Yaéyama, littoral, June 21, and July 14, 1941. One specimen; same locality, littoral, July 9, 1941.

Distribution.—Ryukyu; Ogasawara (Bonin) Islands; Philippine Islands; Amboina; Torres Strait; Caroline Islands.

#### 12. *Ophiarachna ohshimai* sp. nov.

(Text-fig. 1)

Disk about 16 mm in diameter (measured in a broken state); arms 60 mm long. Disk very fragile, rounded, covered with numerous fine granules both above and below, under which many small delicate imbricating scales are concealed. Radial shields naked, small and oval, widely separated from each other.

Oral shields large, about as long as broad, proximal border very rounded, which is continuous to the lateral sides. Supplementary oral shields small, lunular. Adoral shields also small, triangular, longer than broad, limited to the side of oral shield, broadly separated from each other at the interradial area. Oral plates covered with a number of granules, which are coarser than those of disk. Oral papillae seven or rarely eight on a side; distal one terminating upwards; the penultimate largest of all, tetragonal, somewhat broader than long; others rather flat, longer than broad, but blunt at the tip. Teeth five on a jaw, broader than long, stout and rounded at the free end. Genital slits large.

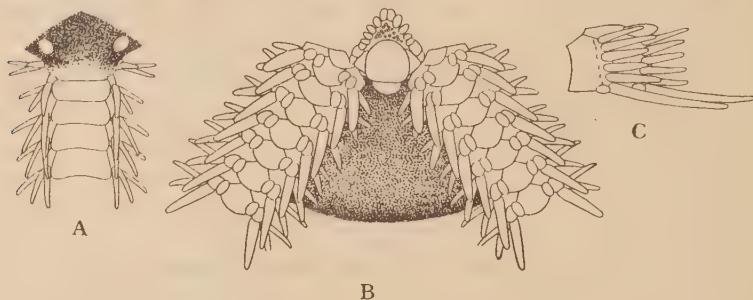


Fig. 1. *Ophiarachna ohshimai*.

A. From above. B. From below. C. Side view of two arm joints near disk.  $\times 3.5$ .

Arms very stout, tapering slowly. Dorsal arm plates well developed, covering the whole dorsal surface of arm, quadrangular, more than twice as wide as long, slightly broader without than within, disto-lateral angles rounded, aboral margin gently curved, broadly in contact with each other till near the tip of arm. First ventral arm plate moderate, much broader than long, distal border rounded. Following plates at first slightly broader than, or as broad as, long, but distally becoming longer than broad; proximal margin three-sided, distal one very convex, lateral sides somewhat reentering; they are in contact with each other. Two pairs of pores are present in one specimen between proximal three plates, but in the other they are inconspicuous. Side arm plates broad, in contact with each other antero-posteriorly, as high as an arm joint, but not meeting both above and below. Arm spines six in number near the disk, but gradually falling to five, four or three

distally, flat and robust; the undermost one largest, more than three times as long as a joint at some distance from the disk, but those of the other part of arm less than the foregoing in length; the others subequal, much longer than a joint. Tentacle scales two to each pore, large, flat, oval; the abradial larger than the adradial.

Colour (dried from alcohol): disk deep grayish olive; but under the microscope variegated with grayish white and dark olive; radial shields dark olive. Dorsal surface of arm deep grayish olive; each plate spotted with white; eight or nine yellowish white narrow bands present on the arm. Ventral side much lighter; mouth parts bearing a small number of blackish olive spots; the ventral arm plates dirty white, bearing a broad transverse stripe of blackish olive. Arm spines annulated alternately with dirty white and blackish olive.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, July 9, 1941. One specimen; same locality, littoral, July 10, 1941.

The species belonging to the genus *Ophiarachna* are five in number, namely *O. incrassata* LAMARCK, *O. affinis* LÜTKEN, *O. mauritiensis* LORIOL, *O. robillardi* LORIOL and *O. quinquespinosa* KŒHLER. *Ophiarachna ohshimai* differs from *O. incrassata*, *O. affinis* and *O. mauritiensis* in possession of naked radial shields. *O. robillardi* which has the radial shields equally naked, but the oral shields are elongate. *O. quinquespinosa* shows no supplementary oral shields, which are present in *O. ohshimai*. This Ophiuran is beautiful and delicate, and the disk is easily broken when it is taken out from among corals. The species is dedicated to Professor Dr. H. OHSHIMA who is one of the pioneers of the district in faunistic researches.

### 13. *Ophiurodon cupidum* (KŒHLER)

*Ophioconis cupida*: KŒHLER, 1905, Siboga-Exp., Oph. litt., p. 15, pl. I, figs. 19-20.  
CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 219.

*Ophiurodon cupidum*: MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 84.  
MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 186.

Locality.—One specimen; Isigaki-sima, Yaéyama, littoral, July 9, 1941.

Distribution.—Moluccas; Sulu Archipelago; Palao Islands.

14. *Ophiopezella spinosa* (LJUNGMAN)

*Ophiarachna spinosa*: LJUNGMAN, 1867, Öfv. Kongl. Vet.-Akad. Förh., XXIII, p. 305.<sup>1)</sup>  
*Pectinura spinosa*: LYMAN, 1874, Bull. Mus. Comp. Zoöl., III, 10, p. 221.  
*Ophiopezella spinosa*: LYMAN, 1882, Challenger Oph., p. 17. CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 120.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 304.  
 KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 338. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 186.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 28, 1941. Two specimens; same locality, littoral, July 2, 1941. Two specimens; same locality, littoral, July 9, 1941. One specimen; same locality, littoral, July 10, 1941.

Distribution.—Tonga Islands; Fiji Islands; Amboina; Society Islands; Island of Nusa Laut; Philippine Islands; Zamboanga; Kei Islands; Palao Islands; Torres Strait.

15. *Ophiarachnella gorgonia* MÜLLER et TROSCHEL

*Ophiarachna gorgonia*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 105.  
*Pectinura gorgonia*: LÜTKEN, 1869, Add. Hist. Oph., III, p. 33.  
*Ophiarachnella gorgonia*: CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 117.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 305. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 323, pl. VI, fig. 7. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 33.—1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 187, fig. 9.

Localities.—Two specimens; Isigaki-sima, Yaéyama, littoral, June 28, 1941. Three specimens; same locality, littoral, July 2, 1941. Four specimens; same locality, littoral, July 9, 1941.

Distribution.—Indo-Pacific.

16. *Ophiarachnella septemspinosa* (MÜLLER et TROSCHEL)

*Ophiarachna septemspinosa*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 105.  
*Pectinura septemspinosa*: LÜTKEN, 1869, Add. Hist. Oph., III, p. 33.  
*Ophiarachnella septemspinosa*: CLARK, 1909, Bull. Mus. Comp. Zoöl., LII, 7, p. 126.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 305. - 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 142, pl. XII, fig. 7.

Localities.—Three specimens; Isigaki-sima, Yaéyama, littoral, July 2, 1941. One specimen; same locality, littoral, July 9, 1941.

Distribution.—Zanzibar; Mauritius; Zamboanga; Ceylon; Moluccas; Amboina; off Borneo; Torres Strait; Fiji Islands.

<sup>1)</sup> Not accessible to me.

This large beautiful Ophiuran has not yet been reported north of the Philippine Islands. But at Isigaki-sima this was found to be one of the most common Ophiurans, inhabiting the reef flat.

Family Ophiochitonidae

17. *Ophionereis aplacophora* sp. nov.<sup>1)</sup>

(Text-fig. 2)

Disk 10.5 mm in diameter; arms about seven times as long as the disk diameter. Breadth of arm 1.5 mm near the disk, but becoming 2.5 mm at the middle of arm.

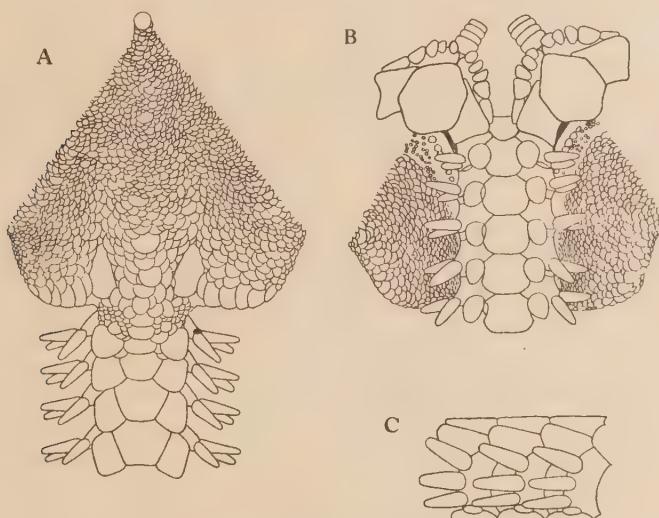


Fig. 2. *Ophionereis aplacophora*.

A. From above. B. From below. C. Side view of three arm joints near disk.  $\times 7$ .

Disk flat, five-lobed, concave at the interradial border, covered with numerous small, firm scales, among which those around the radial shields are larger. On the interradial border is a row of conspicuous scales, which starts from the radial shield and reaches near the middle. Radial shields small, broadly separated from each other, pear-seed shaped. Interbrachial spaces below covered with the same sort of scaling as that of the disk and furnished with a

<sup>1)</sup> *A*, signifying *absence*, *πλάκ*, signifying *plate*, and *φορά*, signifying *carrying*, in reference to having no scale-like supplementary plates between the side arm plates.

number of granules near the oral shield. Genital slit long, but inconspicuous, provided with papillae.

Oral shields moderate, hexagonal, longer than broad, slightly broader without than within, with angles rounded. Adoral shields conspicuous, tetragonal, broader within than without, not meeting on the interradial line, widely separating the first side arm plate from the oral shield. Oral plates indistinct. Oral papillae five on a side of an oral angle, thick and stout; distal one small, bluntly pointed at the tip; the penultimate largest of all, squarish, broader than long; following two longer than broad; the proximal one rounded. Teeth five on a jaw, squarish thick and stout; the undermost one smallest.

Dorsal arm plates well developed, trapezoid, much broader than long, broader within than without, proximal border more or less three-sided, distal border slightly concave at the middle, fully in contact with each other till the tip of arm. At the base of arm they are small and scale-like. Supplementary dorsal arm plates rather large, triangular, with a disto-lateral angle rounded. First ventral arm plate small, broader than long, distal border very rounded. Following plates tetragonal, slightly wider without than within, proximal border three-sided, lateral side reentering, distal one gently curved, in contact with each other along the whole length; basal one or two longer than broad, but soon becoming broader than long distally. Side arm plates not meeting both above and below; each carries three arm spines, which are subequal, slightly longer than a joint, blunt, stout and flat. Tentacle scale one to each pore, large, oval.

Colour (dried from alcohol): disk light gray, ornamented with narrow chocolate lines irregularly. Arms also light gray, with imperfect chocolate bands at each two or three arm joints. The ventral side also light gray. Ventral side of arm furnished with light olive flecks.

Locality.—One specimen; Isigaki-sima, Yaéyama, littoral, July 10, 1941.

The present species is closely related to *O. eurybrachyplax* CLARK, *O. porrecta* LYMAN, *O. reticulata* (SAY) and *O. sophiae* BROCK. It is easily distinguished from *O. eurybrachyplax* by the hexagonal oral shields and by the trapezoid dorsal arm plates. It is also different from *O. porrecta* in having no scale-like supple-

mentary plates between the side arm plates. Further, it differs from *O. reticulata* in subequal arm spines, and from *O. sophiae* in non-granulated arms.

### Family Ophiocomidae

#### 18. *Ophiocoma brevipes* PETERS

PETERS, 1852, Arch. Naturg., p. 85.<sup>1)</sup> CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 291. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 343, fig. 85. KŒHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 319, pl. LXXII, figs. 6-9. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 129, pl. XIII, fig. 7, pl. XXXIV, figs. 3-4. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 34.—1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 193.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 24, 1941. Three specimens; same locality, littoral, June 25, 1941. Two specimens; same locality, littoral, July 2, 1941. One specimen; same locality, littoral, July 9, 1941. Four specimens; same locality, littoral, July 10, 1941.

Distribution.—Zanzibar; Mauritius; Southern Nippon; Philippine Islands; Amboina; New Guinea; Torres Strait; Queensland; Lord Howe Island; Palao Islands; Ponape; Gilbert Islands; Fiji Islands; Hawaii.

#### 19. *Ophiocoma erinaceus* MÜLLER et TROSCHEL

*Ophiocoma erinaceus*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 98. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 291.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 127. KŒHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 322, pl. LXXIII, fig. 7. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 194.

*Ophiocoma scolopendrina* var. *erinaceus*: MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 345, fig. 96.

Localities.—Two specimens; Isigaki-sima, Yaéyama, littoral, June 23, 1941. Two specimens; same locality, littoral, June 24, 1941. Two specimens; same locality, littoral, June 28, 1941.

Distribution.—Mozambique; Zanzibar; Mauritius; Southern Nippon; Philippine Islands; Amboina; Torres Strait; Palao Islands; Ponape; Gilbert Islands; Marshall Islands; Society Islands; Hawaii Islands.

<sup>1)</sup> Not accessible to me.

20. *Ophiocoma latilanxa* MURAKAMI

MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 194, fig. 13.

Localities.—Two specimens; Isigaki-sima, Yaéyama, littoral, July 2, 1941. Four specimens; same locality, littoral, July 9, 1941. Four specimens; same locality, littoral, July 10, 1941.

Distribution.—Palao Islands.

21. *Ophiocoma pica* MÜLLER et TROSCHEL

*Ophiocoma pica*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 101. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 293.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 127, pl. XIII, fig. 8. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 196, fig. 14.

*Ophiocoma lineolata*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 102. KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 324, pl. LXXIII, figs. 1-4.

Localities.—Two specimens; Isigaki-sima, Yaéyama, littoral, July 2, 1941. One specimen; same locality, littoral, July 3, 1941. Two specimens; same locality, littoral, July 9, 1941.

Distribution.—Zanzibar; Red Sea; Paumotu Islands; Banda; Amboina; Torres Strait; Gilbert Islands; Society Islands; Hawaii Islands.

It is very curious that the present species has not hitherto been known from Yaéyama, for this is one of the most common Ophiurans at the island. I could meet with numerous individuals on the flat. The yellowish stripes of disk are not so marked as those of the specimens got at Tokobei.

22. *Ophiocoma scolopendrina* (LAMARCK)

*Ophiura scolopendrina*: LAMARCK, 1816, Anim. sans Vert., II, p. 544.

*Ophiocoma scolopendrina*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 101. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 293, pl. XIV, figs. 10-11.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 125, pl. XIII, fig. 9. KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 325, pl. LXXIII, fig. 5, pl. LXXIV, figs. 1-7. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 196.

*Ophiocoma scolopendrina* typical: MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 346, pl. VII, figs. 4-5.

Localities.—Five specimens; Isigaki-sima, Yaéyama, littoral, June 1940 (MIYAKE). Six specimens; same locality, littoral, June 23, 1941.

Distribution.—Cape of Good Hope; Mozambique; Zanzibar; Madagascar; Arabian Gulf; Ryukyu; Philippine Islands; Halmahera;

Amboina; New Guinea; Palao Islands; Caroline Islands; Marshall Islands; Gilbert Islands; Fiji Islands; Society Islands.

### 23. *Ophiomastix annulosa* (LAMARCK)

*Ophiura annulosa*: LAMARCK, 1816, Anim. sans Vert.. II, p. 543.

*Ophiomastix annulosa*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 107. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 289, pl. XVI, fig. 11. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 350, fig. 99, pl. VII, fig. 6. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 135, pl. XIV, fig. 6. KEHLER, 1922, U. S. Nat. Mus., Bull. 100, V, p. 329, pl. LXXII, figs. 4-5. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 197.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 1940 (Miyake). Two specimens; same locality, littoral, June 23, 1941. Two specimens; same locality, littoral, June 24, 1941.

Distribution.—Ceylon; Keeling Islands; Ryukyu; Taiwan (Formosa); Philippine Islands; Amboina; Torres Strait; Palao Islands.

### 24. *Ophiomastix asperula* LÜTKEN

LÜTKEN, 1869, Add. Hist. Oph., III, p. 43. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 290, pl. XV, figs. 9-9a. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294. —1921, Dept. Mar. Biol. Carnegie Inst., X, p. 134, pl. XIV, fig. 1. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 197, fig. 15.

Locality.—Two specimens; Isigaki-sima, Yaéyama, littoral, July 9, 1941.

Distribution.—Zanzibar; Zamboanga; Amboina; East coast of Borneo; Torres Strait; Fiji Islands.

### 25. *Ophiomastix caryophyllata* LÜTKEN

LÜTKEN, 1869, Add. Hist. Oph., III, p. 43. DÖDERLEIN, 1896, SEMON-Zool. Forschungsr., V, p. 290, pl. XV, figs. 10-10a. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 294.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 137, pl. XIV, fig. 4, pl. XXXVI, fig. 10. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ. VII, 5, p. 198, fig. 16.

Locality.—Two specimens; Isigaki-sima, Yaéyama, littoral, July 9, 1941.

Distribution.—Amboina; Off east coast of Borneo; Sulu Archipelago; New Caledonia; Torres Strait; Palao Islands; Fiji Islands.

26. *Ophiomastix lütkeni* PFEFFER

PFEFFER, 1900, Abh. Senckenb. Nat. Ges., XXV, p. 83.<sup>1)</sup> CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 296, pl. XVI, figs. 3-4. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 349, fig. 98.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, July 2, 1941. One specimen; same locality, littoral, July 3, 1941. Two specimens; same locality, littoral, July 10, 1941.

Distribution.—Ryukyu; Philippine Islands; Ternate.

27. *Ophiomastix mixta* LÜTKEN

LÜTKEN, 1869, Add. Hist. Oph., III, p. 44. KÖHLER, 1905, Siboga-Exp., Oph. litt., p. 68, pl. VI, fig. 15, pl. XV, fig. 1. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 256, fig. 126.—1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 296. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 348, fig. 97. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 135, pl. XIV, fig. 2. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 34.—1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 199.

Localities.—One specimen; Isigaki-sima, Yaéyama, littoral, June 24, 1941. One specimen; same locality, littoral, June 25, 1941.

Distribution.—Southern Nippon; Philippine Islands; Amboina; Timor; Torres Strait; Samoa; Loyalty Islands; Fiji Islands.

28. *Ophiarthrum elegans* PETERS

PETERS, 1851, Monatsb. K. Preuss. Akad. Wiss., p. 453. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 296. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 351, fig. 100, pl. VII, fig. 7. CLARK, 1921, Dept. Mar. Biol. Carnegie Inst., X, p. 139, pl. XIII, fig. 1. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ. VII, 5, p. 201.

Localities.—Four specimens; Isigaki-sima, Yaéyama, littoral, June 28, 1941. Two specimens; same locality, littoral, July 2, 1941. One specimen; same locality, littoral, July 9, 1941.

Distribution.—Mozambique; Zanzibar; Zamboanga; Ryukyu; Philippine Islands; Queensland; Palao Islands; New Guinea; Torres Strait; Caroline Islands; Society Island.

28'. *Ophiarthrum elegans* var. *unicolor* CLARK

CLARK, 1932, Gt. Barrier Reef Exp., IV, 7, p. 208. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 201.

<sup>1)</sup> Not accessible to me.

Localities.—Two specimens; Isigaki-sima, Yaéyama, littoral, June 28, 1941. One specimen; same locality, littoral, July 2, 1941. One specimen; same locality, littoral, July 9, 1941.

Distribution.—Great Barrier Reef; Palao Islands.

### 29. *Ophiarthrum pictum* (MÜLLER et TROSCHEL)

*Ophiocoma picta*: MÜLLER et TROSCHEL, 1842, Sys. Ast., p. 102.

*Ophiarthrum pictum*: LYMAN, 1874, Bull. Mus. Comp. Zoöl., III, 10, p. 225, pl. VII, figs. 2-4. CLARK, 1915, Mem. Mus. Comp. Zoöl., XXV, 4, p. 297.—1921, Dept. Mar. Biol. Carnegie Inst., X, p. 140, pl. XII, fig. 1. OHSHIMA, 1935, Bot. Zool., III, 3, p. 62, fig. 28, b-c. MURAKAMI, 1943, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 5, p. 202.

Locality.—Two specimens; Isigaki-sima, Yaéyama, littoral, July 2, 1941.

Distribution.—Yaéyama; Philippine Islands; Amboina; East Indies; Timor; Torres Strait; Palao Islands; New Guinea.

(Amakusa Marine Biological Laboratory, Kumamoto-ken)

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## OPHIURANS FROM SOME GULFS AND BAYS OF NIPPON<sup>1)</sup>

Shiro MURAKAMI

The Ophiuran material upon which the present paper was based had been collected by Professor Dr. D. MIYADI and Mr. T. MASUI of the Zoological Institute, Kyōto Imperial University, in the gulfs and bays of Ago, Gokasyo, Matoya, Ise, Mikawa, Beppu, Hakata (or Hukuoka) and Nanao, during their study of the marine benthic communities, and was submitted to me by them for identification. I could distinguish the following ten forms in it, among which two are described here for the first time. The list of the species is as follows:

### Order Gnathophiurida

#### Family Amphiuridae

1. *Amphioplus diacritus* sp. nov.
2. *Amphioplus miyadii* sp. nov.
3. *Amphichilus trichoides* MATSUMOTO
4. *Ophiophragmus japonicus* MATSUMOTO
5. *Ophiophragmus japonicus* var. *parvus* MATSUMOTO
6. *Amphiura aestuarii* MATSUMOTO
7. *Amphiura sinicola* MATSUMOTO

#### Family Ophiotrichidae

8. *Ophiothrix koreana* DUNCAN
9. *Ophiothrix marenzelleri* KOEHLER

### Order Chilophiurida

#### Family Ophiolepididae

10. *Ophiura kinbergi* (LJUNGMAN).

The habitat in reference to the respective species is shown in Table 1.

It has been already known that all the described species, except *A. trichoides* whose locality was unknown, live in Nipponese

<sup>1)</sup> Contributions from the Zoological Laboratory, Kyūsyū Imperial University, No. 166; Papers from the Amakusa Marine Biological Laboratory, No. 89.

bays. Thus, *Ophiophragmus japonicus* has been reported from Kagosima Bay and Mutu Bay, *O. japonicus* var. *parvus* from Mutu Bay, *Amphiura aestuarii* from Aburatubo Cove, *A. sinicola* from Mutu Bay, *Ophiothrix koreana* from Hakodate Bay, Gulf of Tokyo, Suruga Gulf and Kagosima Bay, *O. marenzelleri* from Gulf of Tokyo, Kagosima Bay, Asami Bay, Tusima, and Mutu Bay, and *Ophiura kinbergi* from Kagosima Bay and Mutu Bay. In the present paper more numerous localities are added to the foregoing ones. *Amphichilus trichoides* is represented by numerous specimens in the collection, and is thought to be also one of the common dwellers in our bays.

Table 1.

Bay	Species	<i>A. diacritus</i>	<i>A. miyadai</i>	<i>A. trichoides</i>	<i>O. japonicus</i>	<i>O. japonicus</i> var. <i>parvus</i>	<i>A. aestuarii</i>	<i>A. sinicola</i>	<i>O. koreana</i>	<i>O. marenzelleri</i>	<i>O. kinbergi</i>
Ago		x	x	x			x				
Gokasyo	x	x	x			x	x				
Matoya	x		x	x	x	x			x	x	
Ise					x					x	
Mikawa										x	
Beppu		x		x						x	
Hakata	x								x		
Nanao	x	x		x	x	x	x				

Among those Ophiurans, *O. kinbergi* is widely distributed in the Indo-Pacific region, and reaches as far as Otaru, which seems to be its known northern limit, *O. koreana* ranges from Malaysian waters to Nippon, and the rest are known only from vicinities of Honshū.

Before proceeding further, I must express my sincere thanks to Professor Dr. H. OHSHIMA for his kindly guidance given to me during the work. I must also express my gratitude to Professor Dr. D. MIYADI and Mr. T. MASUI for their kindness in giving me the valuable material.

## SYSTEMATICS

## Family Amphiuridae

1. *Amphioplus diacritus* sp. nov.<sup>1)</sup>

(Fig. 1)

Disk about 10 mm in diameter; arms all broken off at the base, but probably more than three times as long as the disk diameter in the intact state, as considered from the fragments. Breadth of arm 1.8 mm at the base.

Disk rounded, or five-lobed, notched at the interradial border, flat, covered with numerous thin, imbricating scales, among which

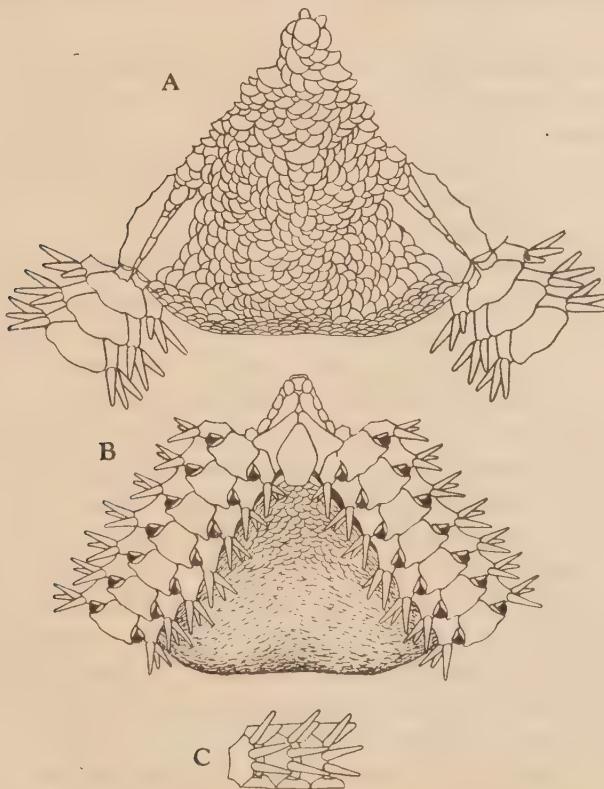


Fig. 1. *Amphioplus diacritus.*  $\times 7$ .

A. From above. B. From below. C. Side view of three arm joints near disk.

<sup>1)</sup> Διακρίτος, signifying *separated*, in reference to the non-continuous adoral shields.

the peripheral ones are somewhat distinct. Primary plates not very large, but distinguishable. Radial shields of moderate size, a little less than one half of the disk radius in length, very narrow, more than four times as long as broad, bluntly pointed at the proximal end, somewhat enlarged distally, but the broadest part is at some distance from the distal end; they are diverging within and scarcely in contact without. Interbrachial spaces below covered with small imbricating scales.

Oral shields large, pentagonal, longer than broad, with rounded angles and gently curved margins. Madreporite largest of all, also pentagonal, broader than the remaining ones. Adoral shields also distinct, long and narrow, enlarged distally, tapering within where they are in contact with each other or otherwise, producing an outer lobe so as to separate the first side arm plate from the oral shield. Oral plates rather small, higher than broad. Oral papillae four in number on a side of an oral angle; the one at the apex of jaw largest, thick, stout, but blunt at the tip; following two rectangular, also stout; the distal one somewhat triangular, about as large as the foregoing.

Dorsal arm plates large, tetragonal, about two times as broad as long, with distal angles rounded; proximal border narrower than the distal one which is rather straight; lateral sides diverging distally; they are in contact with each other and are keeled at the centre longitudinally. First ventral arm plates small, hexagonal, slightly longer than broad. Following plates tetragonal or pentagonal, broader without than within, with lateral sides concave; at first they are broader than long and have a lobe at the middle of distal border, but distally they become longer than broad and the lobe becomes indistinct, or disappears. They are in contact with each other. Side arm plates somewhat prominent, not meeting both above and below. Arm spines three in number, stout, not sharply pointed at the tip, longer than a joint, among which the middle one is the largest. Tentacle pores large, protected by two elongate scales forming a right angle.

Colour (dried from alcohol): disk dirty gray; dorsal side of arm mineral gray; ventral side light gray.

Localities.—Station 22, Gokasyo Bay, Mié-ken, April 19-20, 1941; one specimen. Station 44b, the same bay, April 19-20, 1941; one specimen. Station 61, Matoya Bay, Mié-ken, April 15-17, 1941;

one specimen. Station 63, the same bay, April 15-17, 1941; one specimen. Station 88, the same bay, April 15-17, 1941; one specimen. Station 94, the same bay, April 15-17, 1941; one specimen. Station 95, the same bay, April 15-17, 1941; one specimen.

The present species is closely allied to *A. luctator* KOEHLER, the disk of which was not known, but differs from it in the close-set apical oral papillae, in the non-continuous adoral shields, in the hexagonal first ventral arm plates, in the shape of succeeding ventral arm plates, and in the elongate tentacle scales.

## 2. *Amphioplus miyadii* sp. nov.

(Fig. 2)

Disk 9 to 10 mm in diameter; arms torn away, but probably attain the length more than four times as long as the disk diameter. Breadth of arm 1.5 mm at the base.

Disk pentagonal or five-lobed, slightly notched at the base of arm, rather flat, covered with a smooth coating of coarse, thin, imbricating scales, among which those near the margin are smaller than the rest. Primary plates indistinct. Radial shields of moderate size, about two-fifths of disk radius in length, three times as long as broad, tapering proximally to a point, broadest at the middle part, somewhat rounded without, in contact with each other throughout the distal three-fifths of the length, but separated proximally by a few intervening scales. Interbrachial spaces below covered with numerous small, imbricating scales, which are smaller than those of the dorsal side of disk. Genital slits long.

Oral shields small, rhomboidal, with acute proximal, and rounded lateral and distal angles, much longer than broad; proximal borders are almost straight, but the distal ones are somewhat concave. Madreporite largest of all, also rhomboidal, with a very rounded distal angle. Adoral shields triangular, tapering within, where they are in contact with each other or not, enlarged distally. Oral plates small, higher than broad. Oral papillae four in number, thick and robust; the one at the apex of jaw longer than broad, but blunt at the tip, widely separated from the opposite one; the next one is about as large as the foregoing, tetragonal; the following two are triangular in shape, among which the penultimate is the largest, but not so sharply pointed

at the end as in the distal one. Teeth six or seven in number, tetragonal, thick and stout; the one situated ventrally is broader than long, while the upper ones are much longer than broad.

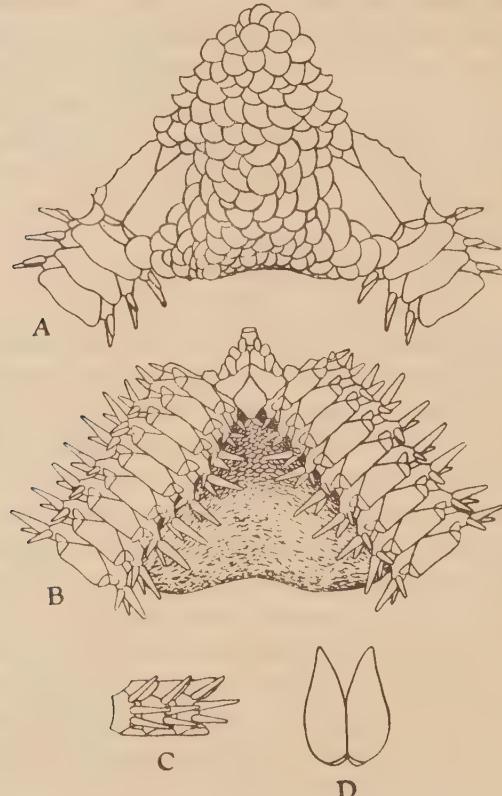


Fig. 2. *Ampioplus miyadiei.*  $\times 7$ .

A. From above. B. From below. C. Side view of three arm joints near disk. D. Radial shields of other specimen.

Arms stout, broader than high, slowly tapering distally. Dorsal arm plates well developed, tetragonal, with disto-lateral angles rounded; proximal border narrower than the distal one, which is gently curved so as to give the plate a somewhat tri-lobed appearance; lateral sides are remarkably diverging distally; they are fully in contact with each other. First ventral arm plates small, pentagonal, somewhat broader than long, with a distal border convex. Succeeding plates pentagonal, with a wide proximal angle,

much broader than long, scarcely in contact with each other. Side arm plates narrow, broadly separated from each other on the dorsal side of arm, but less so below. Arm spines three in number, longer than a joint, stout and pointed at the tip: the middle one is the largest. Each tentacle pore furnished with two large, somewhat triangular scales which are set at right angles to each other.

Colour (dried from alcohol); dirty white.

Localities.—Station 46, Ago Bay, Mié-ken, Nov. 5-10, 1940; three specimens. Station 70, the same bay, Nov. 5-10, 1940; one specimen. Station 14, Gokasyo Bay, Mié-ken, April 19-20, 1941; one specimen. Station 16, the same bay, April 19-20, 1941; one specimen. Station 32, the same bay, April 19-20, 1941; two specimens. Station 35, the same bay, April 19-20, 1941; one specimen. Station 44b, the same bay, April 19-20, 1941; one specimen. Station 45, the same bay, April 19-20, 1941; one specimen. Station 38, Beppu Bay, Ōita-ken, Aug. 22-28, 1940; one specimen. Station 40, the same bay, Aug. 22-28, 1940; one specimen. Station 29, Hakata Bay, Hukuoka-ken, June 2-3, 1941; one specimen. Station 45, the same bay, June 2-3, 1941; one specimen. Station 47, the same bay, June 2-3, 1941; one specimen. Station 56, the same bay, June 2-3, 1941; one specimen. Station 78, the same bay, June 2-3, 1941; one specimen. Station 38, Nanao Bay, Isikawa-ken, Aug. 13-18, 1941; one specimen.

The present species is so closely related to *A. relictus* (KOEHLER) that I hesitated at first to make it separate from the latter. But, finding that our form has the narrow radial shields, different from *A. relictus*, and that being a constant character, I have come to convince me justified to establish a new species therefrom. The species is dedicated to Professor Dr. D. MIYADI of Kyōto Imperial University.

### 3. *Amphichilus trichoides* MATSUMOTO

MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 175, fig. 45.

Localities.—Station 54, Ago Bay, Mié-ken, Nov. 5-10, 1940; one specimen. Station 16, Gokasyo Bay, Mié-ken, April 19-20, 1941; one specimen. Station 19, the same bay, April 19-20, 1941; one specimen. Station 20, the same bay, April 19-20, 1941; one

specimen. Station 30, the same bay, April 19-20, 1941; one specimen. Station 38, the same bay, April 19-20, 1941; one specimen. Station 42, the same bay, April 19-20, 1941; one specimen. Station 44a, the same bay, April 19-20, 1941; one specimen. Station 48, the same bay, April 19-20, 1941; one specimen. Station 47, Matoya Bay, Mié-ken, April 15-17, 1941; one specimen. Station 56, the same bay, April 15-17, 1941; one specimen. Station 73, the same bay, April 15-17, 1941; one specimen. Station 74, the same bay, April 15-17, 1941; one specimen. Station 78, the same bay, April 15-17, 1941; one specimen. Station 86, the same bay, April 15-17, 1941; one specimen. Station 88, the same bay, April 15-17, 1941; one specimen. Station 89, the same bay, April 15-17, 1941; one specimen. Station 92, the same bay, April 15-17, 1941; one specimen. Station 12, Nanao Bay, Isikawa-ken, May 13-19, 1941; two specimens. Station 14, the same bay, May 13-19, 1941; one specimen. Station 20, the same bay, May 13-19, 1941; two specimens. Station 22, the same bay, May 13-19, 1941; one specimen. Station 31, the same bay, May 13-19, 1941; one specimen.

Distribution.—Sagami Sea (?)

Some of the specimens at hand agree well with the type, which was described by MATSUMOTO based on a single specimen from unknown locality. But a number of specimens are different from the type in having the longer oral shields with an acute proximal angle and a much rounded distal border, and in having four oral papillae on a side. But these two distinct forms are perfectly connected with each other by intermediate specimens.

#### 4. *Ophiophragmus japonicus* MATSUMOTO

MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 70. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 239. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 183, fig. 48, pl. IV, fig. 3.—1918, Annot. Zool. Japon., IX, 4, p. 478.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 333, fig. 2.

Localities.—Station 30, Ago Bay, Mié-ken, Nov. 5-10, 1940; one specimen. Station 4, Matoya Bay, Mié-ken, April 15-17, 1941; one specimen. Station 13, the same bay, April 15-17, 1941; one specimen. Station 55, the same bay, April 15-17, 1941; one specimen. Station 93, the same bay, April 15-17, 1941; one specimen. Station 16, Ise Bay, July 29-Aug. 3, 1940; two specimens. Station

47, the same bay, July 29-Aug. 3, 1940; one specimen. Station 93, Mikawa Bay, Aiti-ken, July 29-Aug. 3, 1940; one specimen. Station 20, Beppu Bay, Ōita-ken, Aug. 22-28, 1940; one specimen.

Distribution.—Off Namami, Kagoshima Bay. Enoura, Suruga. Off Oginohama, Rikuzen. Mutu Bay. Bay of Thai (Siam). Amboina.

##### 5. *Ophiophragmus japonicus* var. *parvus* MATSUMOTO

MATSUMOTO, 1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 334, figs. 3-4.

Localities.—Station 93, Matoya Bay, Mié-ken, April 15-17, 1941; one specimen. Station 22, Nanao Bay, Isikawa-ken, May 13-19, 1941; one specimen. Station 34, the same bay, May 13-19, 1941; one specimen. Station 51, the same bay, May 13-19, 1941; one specimen. Station 52, the same bay, May 13-19, 1941; one specimen. Station 59, the same bay, May 13-19, 1941; one specimen. Station 69, the same bay, May 13-19, 1941; one specimen. Station 96, the same bay, May 13-19, 1941; one specimen. Station 102, the same bay, May 13-19, 1941; one specimen. Station 105, the same bay, May 13-19, 1941; one specimen. Station 133, the same bay, May 13-19, 1941; two specimens. Station 145, the same bay, May 13-19, 1941; one specimen. Station 146, the same bay, May 13-19, 1941; one specimen.

Distribution.—Ōse, off Yunosima, Mutu Bay.

The present variety was recently described by MATSUMOTO based on the specimens from Mutu Bay. The full grown specimens in the collection are well accordant with the type, and are easily distinguished from the typical form of the species. The radial shields are longer than broad, and the marginal scales of disk are very indistinct, especially at the middle of the interradial border. Further, the scales of the dorsal side of disk are coarser than those of the typical form.

##### 6. *Amphiura aestuarii* MATSUMOTO

MATSUMOTO, 1915, Proc. Acad. Nat. Sci. Philadelphia, p. 73.—1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 208, fig. 57.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 341.

Localities.—Station 40, Ago Bay, Mié-ken, Nov. 5-10, 1940; three specimens. Station 4, Gokasyo Bay, Mié-ken, April 19-20,

1941; one specimen. Station 82, Matoya Bay, Mié-ken, April 15-17, 1941; one specimen. Station 96, the same bay, April 15-17, 1941; one specimen. Station 104, the same bay, April 15-17, 1941; six specimens. Station 105, the same bay, April 15-17, 1941; three specimens. Station 95, Nanao Bay, Isikawa-ken, May 13-18, 1941; two specimens. Station 96, the same bay, May 13-18, 1941; three specimens. Station 97, the same bay, May 13-18, 1941; one specimen. Station 102, the same bay, May 13-18, 1941; one specimen. Station 103, the same bay, May 13-18, 1941; one specimen. Station 115, the same bay, May 13-18, 1941; one specimen.

**Distribution.**—Aburatubo, Misaki.

A close examination of the specimens at hand makes me believe that they belong to *A. aestuarii*, especially in having the large radial shields, in the size and arrangement of the scales around them, and in having the dorsal arm plates being large and wide even at the base of arm. It has been known only from Misaki so far. But it seems to me that the range of this species is not limited, as MATSUMOTO has said. In addition to the foregoing localities, I was able to find it at Tomioka, Amakusa.

### 7. *Amphiura sinicola* MATSUMOTO

MATSUMOTO, 1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 339, fig. 7.

**Localities.**—Station 8, Gokasyo Bay, Mié-ken, April 19-20, 1941; two specimens. Station 29, Nanao Bay, Isikawa-ken, May 13-18, 1941; one specimen.

**Distribution.**—Mutu Bay.

The specimens before me are rather of small size, but I am convinced that they belong to *A. sinicola*. Though the distal oral papillae are somewhat large, and about of the same size as the inner oral papillae, they agree with the type in having the small, narrow radial shields, in having the basal dorsal arm plates being not rudimentary and in having the first ventral arm plates longer than wide.

### Family Ophiotrichidae

#### 8. *Ophiothrix koreana* DUNCAN

DUNCAN, 1879, Journ. Linn. Soc. London, XIV, p. 473, pl. XI, figs. 28-32. CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 257, figs. 127-128.—1915, Mem. Mus. Comp. Zoöl.,

XXV, 4, p. 273. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 220, pl. IV, fig. 7. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 20.

Localities.—Station 87, Nanao Bay, Isikawa-ken, May 13-18, 1941; one specimen. Station 105, the same bay, May 13-18, 1941; one specimen. Station 107, the same bay, May 13-18, 1941; one specimen. Station 133, the same bay, May 13-18, 1941; one specimen.

Distribution.—Hakodate. Gulf of Tokyo. Uraga Channel. Sagami Sea. Suruga Gulf. Sea of Nippon. Tyōsen (Korea) Strait. Kagoshima. Off Satuma. Moluccas. Philippine Islands. Banda. Amboina. Kei Islands.

### 9. *Ophiothrix marenzelleri* KOEHLER

*Ophiothrix marenzelleri* : KOEHLER, 1904, Mém. Soc. Zool. Fr., XVII, p. 103, figs. 76-78. CLARK, 1915, Mem. Mus. Comp. Zool., XXV, 4, p. 281. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 220.—1918, Annot. Zool. Japon., IX, 4, p. 478.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 342, fig. 8.

*Ophiothrix hylodes* : CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 126, fig. 130.

Locality.—Station 99, Matoya Bay, Mié-ken, April 15-17, 1941; one specimen.

Distribution.—Tomo, Bingo. Toba, Sima. Misaki. Entrance to the Gulf of Tokyo. Kagoshima Gulf. Tusima. Off Jōgasima. Kominato.

### Family Ophiolepididae

#### 10. *Ophiura kinbergi* (LJUNGMAN)

CLARK, 1911, U. S. Nat. Mus., Bull. 75, p. 37, fig. 9.—1915, Mem. Mus. Comp. Zool., XXV, 4, p. 321. MATSUMOTO, 1917, Journ. Coll. Sci., Imp. Univ. Tokyo, XXXVIII, 2, p. 271, fig. 73.—1941, Sci. Rep. Tōhoku Imp. Univ., Fourth Series, Biol., XVI, 3, p. 343, fig. 9. MURAKAMI, 1942, Journ. Dept. Agric., Kyūsyū Imp. Univ., VII, 1, p. 28.

Localities.—Station 16, Matoya Bay, Mié-ken, April 15-17, 1941; one specimen. Stations 31 and 32, the same bay, April 15-17, 1941; three specimens. Station 3, Ise Bay, July. 29-Aug. 3, 1940; one specimen. Station 15a, the same bay, July 29-Aug. 3, 1940; two specimens. Station 16, the same bay, July 29-Aug. 3, 1940; one specimen. Station 85, Mikawa Bay, Aiti-ken, July 29-Aug. 3, 1940; one specimen. Stations 87 and 88, the same bay, July 29-Aug. 3, 1940; ten specimens. Station 10, Beppu Bay, Ōita-ken,

Aug. 22-28, 1940; one specimen. Station 46, Hakata Bay, Fukuoka-ken, June 2-3, 1941; one specimen. Station 54, the same bay, June 2-3, 1941; one specimen.

Distribution.—Indo-Pacific.

(*Amakusa Marine Biological Laboratory, Kumamoto-ken*)

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